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THE LONG-TERM PERFORMANCE OF INITIAL PUBLIC OFFERINGS IN NASDAQ STOCK MARKET DURING 2002-2005

HAI, NGUYEN THI MINH

MA FINANCE AND INVESTMENT

THE LONG-TERM PERFORMANCE OF INITIAL PUBLIC OFFERINGS IN NASDAQ STOCK MARKET DURING 2002-2005

BY

HAI, NGUYEN THI MINH

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Abstract

Applying the return measurement and methodology in Khurshed et al (1999) the study found underperformance of long-term IPO in NASDAQ stock exchange during a continuous growth period of the stock market similar to previous literature (i.e. Ibbotson, 1975; Ritter, 1991 and Aggarwal and Rivoli, 1993). This implies that investors should not buy IPO stocks within several first trading days and keep them for three years. Also, the study attempts to relate long term underperformance of IPOs in NASDAQ stock exchange to a full set of variables originated from different explanatory theories. Useful advices to investors in similar markets are concluded from empirical findings. If an investor insists in investing in IPOs in long-term, between two IPO stocks he should not invest the small size one, other elements stay the same. IPO stocks of established firms with higher age and more level of multi-nationality are preferred. In a continuous growth period of stock market, long-term investment in IPO stocks with higher volatility is more profitable.

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CHAPTER 1: INTRODUCTION

1.1. Background and purposes

Initial Public Offerings (IPOs) has attracted an increasing attention of both science world and investors over the last two decades. IPO high initial returns and the subsequent poor long run performance are the two anomalies in the literature of finance. Results of studies on the two phenomena are of great importance to not only academics but also to investors for some reasons. Under-pricing phenomenon dictates 'free lunch' profits when one invests in IPOs from their early stage then resell them at very first trading days. On the other hand, IPO long-term underperformance phenomenon implies that the earnings from under-pricing in early days of IPOs cannot compensate the losses of IPO subsequent price declines in the long run. Furthermore, empirical experiences of relations between IPO long-term abnormal returns and characteristics of firms and IPOs will help investors to choose good stocks for their long-term investment.

A huge body in the literature documented IPO under-pricing, which results in positive IPO initial returns such as Stoll and Curley (1970), Reilly (1973), Carter and Manaster (1990). Ibbotson et al (1988) also researched IPOs during 1960-1987 and found a 16.4% higher initial return of IPOs. In contrast of the IPOs high return phenomenon, long-term performance of IPO receives less research attention and is still a controversial issue in the financial literature. While many empirical evidences through time show underperformance of IPO firms after a period of time, typically three or five years in many markets around the world and consider this as a phenomenon, some authors find insignificant higher IPO abnormal returns comparable to non-issuing firms or the whole market.

Ritter (1991) is highly recognized in the literature of IPO long-term performance with the result of a significant mean of IPOs' market adjusted return over -29.13% in the US market in the third year after issuing event. Furthermore, this is the first research attempting to explain the phenomenon of IPOs by

investors' over-optimism through IPO characteristics such as IPO volume at time of floatation and firm characteristics prior to IPOs such as firm age, size and industry. Levis (1993) validated Ritter (1991)'s conclusion using data of 712 IPOs in the UK market from 1980-1988. Also, he added another two variables, firm size and ownership retention at the time of IPOs to explain IPO long-term performance. Khurshed (1999) took a further step in the IPO literature by initiating a rich set of factors to explain abnormal returns of IPO in three-year period post event. Besides factors studied in Ritter (1991) and Levis (1993), Khurshed (1999) claimed that IPO initial returns and multi-nationality also help predict IPO long term performance. Khurshed (1999) used the UK data set and the validity of the research has not been re-tested by subsequent studies in other markets.

Previous research tested all US stock's IPOs long-term performance using AMEX/NYSE/NASDAQ index as the benchmark. However, stocks listed in a stock exchange might have their specified characteristics different from other stock exchange even in the same countries. Thus, it might be biased to adjust returns of all US stock with bench-mark index of only one stock exchange. Moreover, no author has attempted to relate long term underperformance of IPOs in an US stock exchange to a full set of variables originated from different explanatory theories as in Khurshed (1999). Having identified the gap in the literature, this dissertation focused its research in the IPO long-term performance in NASDAQ stock exchange, one of the largest stock exchanges in the US. The first aim of this study is to re-investigate IPO long-term performance of NASDAQ stock market with NASDAQ index as the benchmark and compare results with findings of other papers in the past. Secondly, application of explanatory theories will also be explored by investigating the relationships of a full set of IPOs' and firms' characteristics and future abnormal returns of the IPO sample. Besides contributing to the literature of IPO long-term performance, predictabilities of IPOs' and firms' characteristics in IPOs long-term performance will provide investors with advices in making decision of IPO long-term investment in a similar market.

This dissertation applies the measurement method for three-year holding period market adjusted buy and hold returns and uses similar models as in

Khurshed et al (1999). Also, before applying regression analysis cross-sectional analysis as in Ritter (1991) will be conducted. Underperformance of US IPO stocks found consistent with empirical findings in Ibbotson (1975), Ritter (1991) and Aggarwal and Rivoli (1993). Due to different characteristics of data set, adjustments to models of Khurshed (1999) will be made to investigate relationship between the IPO abnormal returns in long run and explanatory factors.

1.2. Structure

Given the above background and purposes, the dissertation is organized as follows.

Chapter 1- INTRODUCTION provides a brief review of the research background, importance, objectives and methodology of this dissertation.

Chapter 2 – gives the OVERVIEW OF NASDAQ STOCK EXCHANGE

Chapter 3 - DATA COLLECTION mentions the source of research data, deciding factors for data selection and describes the data collection procedure.

Chapter 4 –introduces the METHODOLOGY applied in this dissertation. In this chapter measurement method for initial market adjusted returns and long-term performance of IPO stocks is described. The following part is hypothesis development and model specification for regression analysis.

Chapter 5 – illustrates and analyzes RESEARCH RESULTS obtained from the empirical tests.

Chapter 6- CONCLUSION summarizes research findings and provides research limitations and suggestions for future studies.

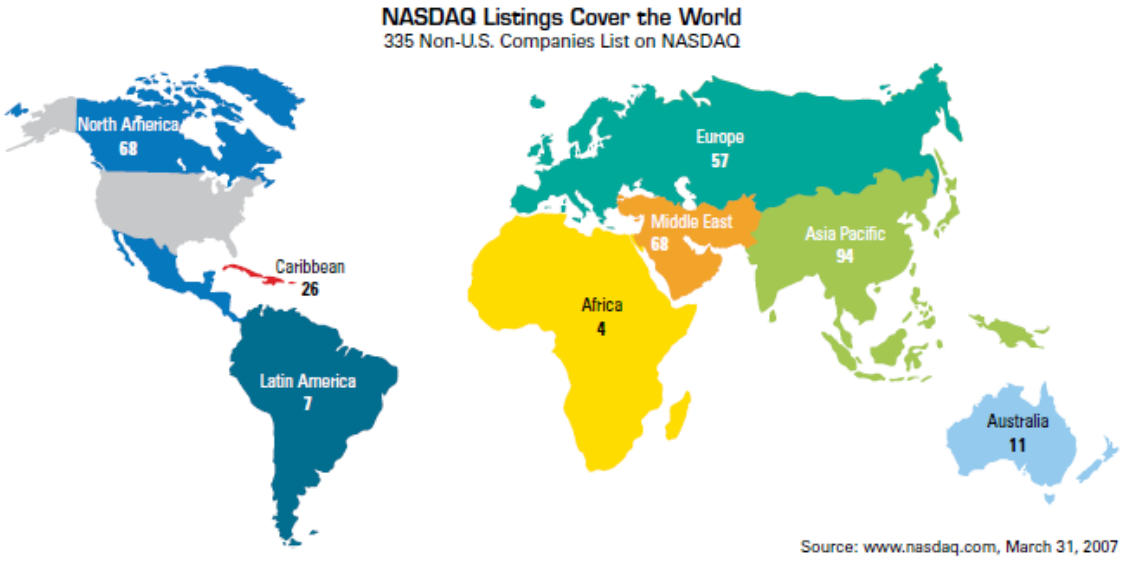
CHAPTER 2: OVERVIEW OF NASDAQ STOCK EXCHANGE

2.1. Brief information

NASDAQ stands for National Association of Securities Dealers Automated Quotations, presently is the largest stock exchange in terms of trading volume and second largest in terms of security value in the United States, following after only the New York Stock Exchange (NYSE). NASDAQ was born on February 8th, 1971 initially to improve trading of over-the-counter (OTC) securities in US market. As its name says, NASDAQ trading is done electronically. In the very first days, trading was conducted through a computer bulletin board system and telephone. Now NASDAQ applies the modest technology of an automated trading system with trade and volume share transactions daily reported.

In 1992 NASDAQ and London Stock Exchange (LSE) first formed the intercontinental linkage of stock markets. In 1998, NASDAQ successfully acquired the third biggest stock market in the US – the American Stock Exchange (AMEX) to found NASDAQ-AMEX Market Group. In 1999 NASDAQ exceeded NYSE in terms of trading volume and became the stock market with highest trading volume per hour in the US as well as around the world. In 2006 NASDAQ attempted to buy the London Stock Exchange, however it abandoned the intention in 2007. Also in this year, NASDAQ began trading Exchange-traded funds (ETFs). In November 2007 NASDAQ acquired the oldest stock exchange in the US –the Philadelphia Stock Exchange. Since the first trading up to now NASDAQ contains over 3,200 listed companies, representing varieties of industries and sectors such as technology, communication, retail, financial services, pharmacy, etc. NASDAQ is a global brand aiming at global reach, with 335 companies are non US from 35 different countries. Still very young, under 40 years-old, NASDAQ has been considered one of the best-quality and biggest stock markets in the world.

Figure 1: NASDAQ Listings Cover the World



Indexes in NASDAQ stock exchange are: NASDAQ Composite Index, NASDAQ global market index, NASDAQ 100 index and NASDAQ 100 financial index. NASDAQ Composite Index was born since the inception of the stock market in 1971, includes regular stocks in NASDAQ. In 1985 NASDAQ 100 was first introduced to the market besides NASDAQ 100 financial index. NASDAQ 100 index includes the largest companies traded in NASDAQ stock exchange in various sectors, competing to Down Jones Industrial Average of NYSE. List of such companies changes every year, discarding some companies and adding new ones.

Electronic trading differentiates NASDAQ from NYSE with traditional trading style on physical trading floor. Besides that, NASDAQ has some characteristics different from NYSE. Many stocks in NASDAQ is highly growth stocks and of technology industry. Among many technology giants listed in NASDAQ stock exchange are Microsoft, Intel, Sun, Apple, Amazon, eBay, Google, Cisco, etc.

2.2. Categories

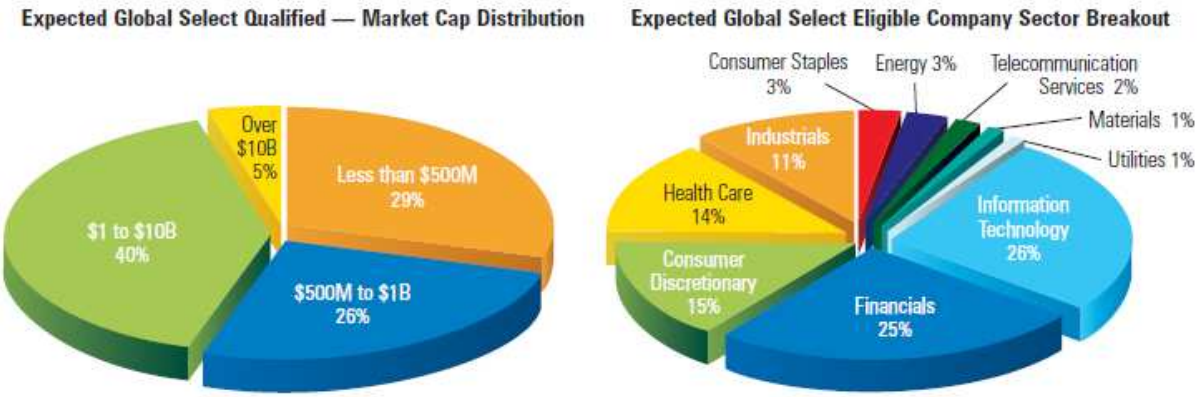
NASDAQ is categorized into three tiers based on firm size and quality: NASDAQ Global Select Market, NASDAQ Global Market, and NASDAQ Capital Market.

NASDAQ Capital Market (CM) is formerly known as the NASDAQ Small-Cap Market. The tier is renamed in 2005 to reflect the fact that this market is not for only small firms but also for medium firms who want to raise capital for business expansion.

NASDAQ Global Market is formerly known as the NASDAQ National Market. As its new name says, NASDAQ Global Market is for both US and international firms. Among the three, this is the largest tier, which has highest trading turnover and liquidity.

Global Select Market is the new market tier in NASDAQ stock exchange effective from July 1st, 2006. This tier has the most stringent financial listing standards in the world in terms of listing companies' market value, earning and liquidity. In other words, companies included in Global Select Market are confirmed to be superior in quality under the commitment of NASDAQ exchange. Global Select Market accounts for about a third of NASDAQ market and represents sector diversification of the whole NASDAQ.

Figure 2: Sectors in NASDAQ Global Select Market



Source: NASDAQ Global Select Market Fact Sheet at NASDAQ.com 2008

If a company wants its stock to be listed in NASDAQ stock exchange it must register with the SEC, satisfy requirements of one of three market categories in the NASDAQ market and have at least three representative market makers. See initial listing requirements of NASDAQ stock exchange in Appendix 1.

Every year, NASDAQ Listing Qualification system will assess all companies listed in the stock exchange, select qualified companies then automatically transfer them from tier NASDAQ Global Market to the NASDAQ Global Select Market. But the choice staying in the third tier – Capital Market or being transferred to the highest tier is of listed companies. In contrast, some poorly performing companies in the highest tier will be moved to the second tier.

CHAPTER 3: LITERATURE REVIEW

3. 1. Long-term IPOs under-performance phenomenon

While many empirical evidences through time show underperformance of IPO firms after three or five years in many markets around the world and consider this as a phenomenon, some authors find insignificant results.

Ibbotson (1975) laid a foundation for research of long run underperformance of US IPOs during 1960-1969. His research on the IPOs registered with the Securities and Exchange Commission in the United States suggests possible saucer-shaped patterns. Average monthly returns of the IPOs data generally have positive performance in the first year, negative performance the following three years and positive performance again in the fifth year.

Using data from 1975-1984 Ritter (1991) compared long term performance of 1,526 US IPOs to their size and industry matching firms and found a substantial underperformance after three-year holding period since their IPOs. The average return of IPOs is 34.47%, much lower than the return of 61.86% of listed stocks matched by size and industry over the same period. According to Ritter (1991) investing in the IPOs at the first day of going public and holding them for three years is not a good strategy because its gain is only 83% compared to investment in the group of listed company in the US stock exchange market.

Loughran (1993) found the difference between NYSE and NASDAQ stocks, previously reported by Reinganum (1990) is because of the large numbers of IPOs in NASDAQ stock exchange during the studied period. Besides that, the author also explored IPO underperformance in NASDAQ stock exchange, expanding Ritter (1991)'s research in terms of time-frame (1967-1987) and number of IPOs (3,656). Data includes all IPOs in the NASDAQ stock market, which are at least large as the smallest NYSE firms. The cumulative average market-adjusted returns of six years holding period are about 59% lower than performance of NASDAQ index.

Loughran and Ritter (1995) again confirmed the IPOs underperformance phenomenon in the US stock market when analyzing companies issuing stock during 1970 to 1990, Initial Public Offerings (IPOs) and Seasoned Equity Offerings (SEOs). The research shows that after five years issuers underperform 44% to non-issuers. As for IPOs, their five-year average return is only 5% compared to 12% of size-matching firms. In the research, Loughran and Ritter mentioned book-to-market effects and finally concluded that they contribute a modest portion to IPOs underperformance.

Servaes and Rajan (1997) analyzed five-year period returns of US IPOs during 1975-1987 based on three different benchmarks. The US IPOs under performance is verified, varying from -17% compared to the portfolio of smallest NYSE/ AMEX firms to -47.1% when adjusted to returns of NYSE/AMEX index. Also, the two authors found a significant fluctuation of the IPOs long-term underperformance over time. Ritter and Welch (2002) reported a 23.4% underperformance of US IPOs that went public during 1980-2001 in three years after their issuing.

On the other hand, having studied returns of IPO in NASDAQ stock exchange during 1981-1985, Buser and Chan (1987) found 11.2% positive risk-adjusted returns of 1,078 IPOs in their sample. Brav and Gompers (1997) classified IPOs in the US market during 1972-1992 into two groups, venture-backed and non-venture-backed IPOs. When comparing equal weighted returns, they found venture-backed IPOs outperformed non-venture-backed ones. Especially, they found no significant underperformance of ventured-backed IPOs, underperformance only occurred to the smallest non-venture-backed firms. They concluded that there is no underperformance of IPO because similar underperformance is also found at non-issuing firm of similar size and book-to-market ratio.

Empirical findings of IPO long-term underperformance in the US market are summarized in the below table.

Table 1: Long-term Underperformance of IPOs in the USA

Research	No	Window	Abnormal returns	Period	Adjustment
Aggarwal and Rivoli (1990)	1598	100 days	-2.83%	1987	NASDAQ index
Ritter (1991)	1256	3 years	-27.39%	1975-1984	Industry and size matching
Loughran (1993)	3656	6 years	-59%	1967-1987	NASDAQ index
Loughran and Ritter (1995)	4753	5 years	-7.4%/year	1979-1990	Size matching firms
Servaes and Rajan (1997)		5 years	-17% -47.10%	1975-1987	Smallest NYSE/AMEX decile NYSE/AMEX index
Carter et al (1998)	2292	3 years	-19.92%	1979-1984	CRSP value-weighted index of AMEX, Nasdaq, NYSE firms.
Ritter and Welch (2002)	6249	3 years	-23.40%	1980-2001	CRSP value-weighted index of AMEX, Nasdaq, NYSE firms.

Note: Window is the number of year which market adjusted returns are examined
No is number of IPOs in the research sample

Source: Collected from Aggarwal and Rivoli (1990), Ritter (1991), Loughran (1993), Loughran and Ritter (1995), Servaes and Rajan (1997), Carter et al (1998), Ritter and Welch (2002)

Similar evidences of IPOs long term underperformance are also predominant in other countries. Levis (1993) validated Ritter (1991)'s conclusion using data of 712 IPOs in the UK market from 1980-1988. Level of IPO underperformance is significant although magnitudes are various among the three benchmarks: the Financial Times Actuaries All Share (FTA) Index, the Hoare Govett Small Companies (HGSC) Index and the All Share Equally Weighted (ASEW) Index. The three-year cumulative average benchmark adjusted returns are -11.38%, -8.31% and - 2.96% respectively. Also, in his research of 346 IPOs during 1980-1985 Levis suggested the continuation of IPO underperformance beyond the third year of public listing, extending the Ritter (1991)'s unresolved part. After that, Espenlaub (2000) tested the robustness of IPO underperformance in 588 UK IPOs during 1985-1992 with several methods applied. Abnormal returns exhibit similar substantial underperformance of IPOs after three years as previous findings. However, negative abnormal returns less significant over five years and much depends on different benchmark, fluctuating from -4.3% to -42.77%. Later, Rindermann (2003)

analyzed the underperformance of IPOs on the London Stock Exchange during 1996-1999 and found no systematic difference between venture capital backed and non-backed IPOs performance.

The outcomes for other developed countries are also dramatic, implying that investment in IPOs in long term is a poor investment, except IPOs in Greece during 1994-2002. Lee et al (1996) found an extensive underperformance of IPOs in Australia three years post-IPO and suggested a 'curvilinear relationship' between initial and IPO long-term returns. Uhlir (1989), Ljungqvist (1997) indicated negative long run performance of Germany IPOs in the 1990s for both Cumulative Abnormal Returns (CARs) and Buy–and–Hold Returns (BHRs) methods. Keloharju (1993) found that, in average, after three years of listing, Finnish IPO stocks lost about 21% compared to the general market. Firth (1997) empirically investigated the significant level of New Zealand IPOs underperformance and its relationship with corporate earnings management and growth rate. Kooli and Suret (2004) reported an average relatively loss of 24,66% (on equally weighted basis) and 15,16% (on value weighted basis) versus the market index if an investor buy Canadian initial issuing stocks and hold them for five years.

Many other studies provide additional evidence of IPOs long term underperformance in developing world. Those include reports of negative three year market adjusted return of -47%, -19.6% and -23.7% for IPOs in Brazil, Mexico and Chile respectively by Aggarwal et al (1993); underperformance of IPOs in Turkey by Kiymaz (2000), in Singapore by Lee et al (1996); Alli et al indicated under-pricing of six months and two years of IPO performance in South Africa. Three- year post listing performance of IPOs on the Shanghai A-share Stock market during 1997-2001 is below the market up to 30% according to research by Cai et al (2007). But still some findings in a smaller number of countries shows a positive market adjusted returns of IPO long-term performance such as cases of IPO in Hungary, Korea, Malaysia, Poland. Other international cases of IPOs long term performance with negative evidence in almost countries can be seen in the below table.

Table 2: International empirical evidences of IPOs Long-term Underperformance

Country	Research	Period	Sample	Short term Returns	Long term Returns
Australia	Lee et al (1996)	1976-1995	381/266	12.10%	-51%
Austria	Ausenegg(2000)	1965-2002	83/57	6.30%	-46.50%
Brazil	Aggarwal et al (1993)	1979-1990	62	78.50%	-47%
Canada	Shaw (1971)	1956-1963	105	--	-32.30%
	Kooli & Suret (2004)	1991-1998	445	--	-16.86
China	Cai et al (2007)	1997-2001			-30%
Chile	Aggarwal et al (1993)	1982-1990	55/28	8.80%	-23.7
Finland	Keloharju (1993)	1984-1989	99/79	10.10%	-21.10%
France	Loughran et al (2006)	1983-2000	571/87	11.60%	-4.80%
Germany	Ljungqvist (1997)	1983-2000	545/145	31.10%	-12.10%
Greece	Thomadakis et al (2007)	1994-2002	254	42.12%	92.93%
Hong Kong	McGuiness(1993)	1980-1990	72	--	-18.30%
Hungary	Lyn and Zychovicz(2003)	1991-1998	33	15.12%	19.59%
Japan	Loughran et al (2006)	1970-2001	1689	28.40%	--
	Cai and Wei (1997)	1971-1990	172	--	-27%
Korea	Kim et al (1995)	1985-1988	99	--	2%
	Dhatt et al (1993)	1980-1990	347	78.01%	4.64%
Malaysia	Dawson (1987)	1978-1984	21	--	18.20%
	Ahmad-Zakuki et al (2004)	1990-2000	454	--	-8.16%
Mexico	Aggarwal et al (1993)	1987-1990	44	--	-19.60%
New Zealand	Loughran et al (2006)	1979-1999	201	23.00%	--
	Firth (1997)	1979-1987	143	--	-10%
Poland	Lyn & Zychowicz (2003)	1991-1998	103	54.45%	57.17%
Singapore	Loughran et al (2006)	1973-2001	441	27%	--
	Hin & Mahmood (1993)	1976-1984	45	--	-9.20%
Spain	Ansotegui et al (2000)	1986-1998	99	10.70%	--
	Alvarez et al (2001)	1987-1997	41	--	-24.19%
Sweden	Loughran et al (2006)	1980-1998	332	30.50%	--
	Loughran et al (1994)	1980-1990	162	--	1.20%
Switzerland	Kunz & Aggarwal (1994)	1983-1989	34	--	-6.10%
Turkey	Loughran et al (2006)	1990-2004	282	10.80%	--
	Yilmaz & Bildik (2005)	1990-2000	234	--	-84.50%
UK	Levis (1993)	1980-1988	712	--	-8.10%
	Loungran & Ritter (1995)	1970-1990	4753	--	-20%
	Brown (1999)	1990-1995	232	--	-9.09%/ -20.051%
	Khurshed (1999)	1991-1995	240	--	-21.98%/ -19.49%
	Espenlaub (2000)	1985-1992	588	--	-4.3%/-28.67%
	Loughran et al (2006)	1960-2001	15333	18.10%	--

Note: Returns may be calculated over different windows. Returns are market-adjusted, not risk-adjusted. Some authors have used different benchmarks and methodologies

Source: collected from Loughran (1994), Gounopoulos et al (2007) and original researches

3.2. Theoretical explanations for IPO long-term underperformance

IPOs long term underperformance phenomenon has been received various explanations. They can be categorized into three main groups.

3.2.1. Explanations based on investors' behaviours and over-optimism

Many economists support the idea of market uncertainty and inefficient at the time of or short time after IPOs (Miller 1977 and 2000); under uncertainty and inefficiency of experimental settings, investors do not always follow rational choice in their decision making (Kahneman and Tversky 1982). In other words, investors' illogical emotion is the main reason behind IPO long term underperformance. IPO stocks underperform the market as soon as their subsequent returns disappoint overoptimistic investors. In the financial literature there are various theories explaining IPO underperformance in long run based upon the core idea of investors' over-optimism in IPO, which leads to IPO under-pricing phenomenon at first and underperformance in long run.

3.2.1.1. The divergence of opinion hypothesis

The divergence of opinion hypothesis was first proposed by Miller (1977). According to the theory, investors have their own ways of valuating stocks and different opinions of what is the true value of an IPO. Miller (1977) suggested that very first buyers of IPOs are the most optimistic with higher expectation than the rest. As a minority of potential investors can absorb the issue, an increase in the divergence of opinions among investors will increase the market initial price. As a result, the stock price will drop as the divergence of opinion between optimistic and pessimistic investor narrow over time. Thus, according to Miller IPOs securities suffer badly underperformance when exists a high level of uncertainty of IPO value at the first sight, followed by a huge difference of initial investors' opinions and strong diminution of stock price towards its fundamental value.

3.2.1.2. The impresario hypothesis

Behaviors of firms' managers and investment bankers further explain investors' overoptimistic phenomenon. Managers and investment bankers have intention to promote IPOs in order to gain profits (Ritter 1991, Baker and Wurgler 2000).

Investment banks may act as 'impresario'. They tend to under-price IPOs, valuating IPOs stock below its true value to attract initial investors. Then, it is possible that after IPOs the market is not immediately efficient at valuing the new issued shares. Newly issued shares previously underpriced, do not immediately come back to their value but are over-evaluated by the early investors, which leads to very high initial IPO stock returns. According to this theory, IPOs will show poor performance after a period of time when market equilibrium is established again (Shiller 1990, Debondt and Thaler 1985, Khurshed et al 1999).

3.2.1.3. Hot issue market

Other authors present a model of 'hot issue market', which also relates to the impresario hypothesis and gives good reason for presence of over-optimism. 'Hot issue market' is the bullish market, when investors are strongly excited about stock trading and believe that the market will continue to increase in the future. In a recent research, Ljungqvist et al (2006) modeled that issuers allocate stocks to regular institutional investors for gradual resale to small investors, who hold optimistic sentiment in a hot issue market. Regular institutional investors gain profits from trading with sentiment investors. Therefore, the share price tends to exceed its fundamental value and subsequently underperform in the long run.

Similarly, Derrien (2005) explained IPO long term underperformance with the appearance of 'noise traders', who are willing to pay a price for IPO shares over their intrinsic value in a bullish market. According to Derrien, the underwriter usually set IPOs at the price between the true value and the hyped price those noise traders investors are willing to pay. Therefore, the hotter the market, the

more noise traders, the more excited investors are, the higher IPO initial price and worse performance of IPO in the long run. Research of Derrien on French stock during 1999-2001 reported IPO long term performance phenomenon in a 'hot issue market' situation at time of IPO. According to the authors, individual investors is the main explanation for optimistic sentiment in bullish market and IPOs long-term performance can be predicted based on investors' demand at the time of IPOs.

In addition, some authors use the definition of 'fad' - a situation of temporary overvaluation caused by over-optimism on the part of investors, to explain for long-term IPO underperformance. Especially, Ang and Schwarz (1985) gave another explanation that IPO investors are by nature less risk-averse and more speculative than other groups of investors. They accept higher level of price volatility and larger deviations from share intrinsic values.

3.2.1.4. Windows of opportunity hypothesis

The argument in 3.2.1.3 is an explanation for 'hot issue market' from the view of investors. Window of Opportunity hypothesis was another explanation for highly excited state of the market towards stock trading from the perspective of issuing companies. Aggarwal and Rivoli (1990), Ritter (1991) and Loughran et al (1994) supported for the theory that IPO underperformance is more serious to stocks going public in the period with high volume of IPOs. Investors' overoptimistic feelings about companies' potential earnings follows a life cycle. Ritter (1991) analyzed that investors are more periodically overoptimistic towards future returns of young fast-growing firms. He also provided empirical experience of worse IPO long-term underperformance in market periods with high volume of IPOs. Baker and Wurgler (2000) investigated that IPOs issuers, who are firm managers and investment bank, can choose the right time at top of the optimistic feeling cycle to issue new shares, taking the advantages of windows of opportunity.

Supporting for this argument, Schultz (2003) presented the pseudo market timing hypothesis. There are more companies going public at good time when IPOs

can be highly evaluated. It is not because of issuers can predict the firms' potential future return, but of the increasing market trend. At the time, investors are in an 'excited state' and have optimistic view of stock trading.

3.2.1.5. Investors' over-reaction after IPO under-pricing

Welch (1992) proposed a model known as 'Sequential sales, learning and cascades' in which potential investors make decision based not only on their own information but also behaviours of other investors. Having seen a successful initial investment, an individual investor may imply that the earlier investors had favorable information about the IPOs shares, and have more incentive towards such investment. Similarly, poor initial sales impact badly the subsequent investment. Although an investor has favourable information and wants to buy shares, he may change his mind as considering that others have no interest in the same investment. Decision of earlier investors, therefore, has an important role to success of the whole share offerings. As a consequence, underwriter and issuer have motivation to coordinate with each other to under-price the IPO aiming at inducing a cascade and ensuring potential investors' frenzy in the offerings. On the initial day of trading overreaction drives share price above fundamental value. In the long run as market is efficient, share price returns to its equilibrium, which explains the negative long-run returns. The IPOs long term underperformance reflects both investors' overreaction and mis-valuation at the time of offering.

In conclusion, explanations based on investors' behaviours and over-expectation suggests two things: (1) The higher initial returns of IPO, which means the higher over-optimism of investors, the lower long term abnormal returns (Ibbotson 1975, Khurshed 1999, Ljungqvist et al 2006). (2) Stocks issued in times with high volumes of IPOs will underperform the market more seriously (Ritter 1991). This study will explore relationship between IPO long-term performance and stock initial returns as well as IPO volume in time of issuing stocks, aiming at testing the above explanatory hypothesis.

As Schwarz stated, IPO investors are more risk-averse. They are willing to accept more risk to receive more awards in return. 6/2002-6/2008 is the growth period in NASDAQ stock exchange. The study also examines the relation of IPO abnormal returns after three years and stock volatility to see if more risk-averse investors actually receive more earnings from their investment.

3.2.2. Explanations based on information asymmetry

Information asymmetry, where exist well-informed and badly informed investors in the market, provides another way of explanation for negative long term performance of companies after IPOs. This also further explains the behavioral hypothesis theories.

3.2.2.1. Earnings management hypothesis

Before IPO, firm requires a group of professionals including investment banker, legal consultant, auditor, etc. for IPO preparation. Firm with help of the group of professionals then files historical financial statements and other business information in the prospectus. As for the IPO firms' financial statements, managers have both motivation and opportunities to manage earnings before and even short term after IPOs, which leads to firms' poor performance in the long run. Firm's earnings affect future earnings forecast and translate directly to its IPO price. If investors use earnings and cash flow statement as guidance to predict potential returns and performance of companies, but are unaware of the artificial earning inflation, they may over estimate the share value (Teoh et al 1998).

Manager tends to report higher earnings to attract investors in their IPOs. Before officially going public, IPO firm and underwriter conduct road show, a series of meetings with potential investors and brokers. These can be considered as a kind of verbal advertisement. As trading begins, firm earnings and projections are widely distributed. As a consequence, analyst and underwriting investment banks are forced to keep the price of IPO stock not drop far below the price on the first

trading day. Thus they have intentions to have favorable projection about future of the issuing company. The IPO firm in turn has motivation to manipulate its financial statement and boost earnings in short term. (Teoh et al 1998).

Due to information asymmetric, there is lot of room for issuing companies to escalate their value before going to public. Rao (1993) found that there is a lack of information of firms in the years before they go public. The main source investors can base on to evaluate IPO companies is their prospectus. Flexibility of financial and accounting standards permits managers to adjust firm earnings before and shortly after the IPOs (Teoh , Weltch and Wong 1998).

Not only managers, analysts also intentionally bias their earnings forecasts towards IPO firms (Ali 1996, Michaely and Womack 1996, Rajan and Servaes 1997, Lin and McNichols 1997, Teoh et al 1998, Dechow et al 1999). Dechow et al (1999) found that both analyst of issuing firms and analyst employed by firm managers give optimistic growth forecast. Analysts earn bonuses as bring client to their investment bank. Due to the conflict of interest, analysts with relation with underwriters tend to be more over-optimistic than those without the relationship. Michaely and Womack (1996) and Lin and McNichols (1997) provided evidence for over-optimism of such affiliated analysts. Teoh and Wong (1997) reported insufficient skepticism of analysts towards IPO firm earnings management.

3.2.2.2. Signaling hypothesis

Stock price in long run depends on characteristics of firm before IPOs. According to signaling hypothesis, Pre-IPO characteristics help investors forecast Company's performance in the future, reducing the information asymmetry risk between investors and issuers. Khurshed et al (1999) initiated a set of firm characteristics and studied importance of each factors to IPO long-run underperformance. This set of firm characteristics includes firm size, risk and quality of the issuers, multi-nationality of firm and firm industry classification.

Many economists have attempted to investigate the relationship between size of offerings and firm long run performance after IPOs. Size of offerings, which is often measured by gross proceeds i.e., the total funds raised at flotation can signal the quality of a company. Researches of Ritter (1991), Loughran and Ritter (1995) and Brav and Gomper (1997), all found that the greater size of offerings, the better IPO firms perform in the long run. This is explained that larger and more quality firms with huge capital resource and high turnover are the ones capable of providing big offerings and usually perform well in the future. Moreover, the small offers usually have to attempt to offset the higher costs of financial distress to gain positive initial returns, as suggested by the earnings management hypothesis. Such abnormal returns by nature should only exist in short term. Therefore, companies with smaller offerings are likely to underperform in the long run. Ritter (1991) confirmed that firm size and IPO long-term performance have a positive linkage although smaller companies can performance better than big ones in short term. On the other side, Gounopoulous (2007) used market capitalization to measure firm size and related firm market capitalization with IPO long-term performance. The negative relationship found contradicts to findings by Ritter (1991) and Levis (1993).

A substantial numbers of researches consider risk as a determinant of IPO long- term performance. Ritter (1984) and Carter (1998) uses firm age as a proxy for risk and found a positive relationship between firm age and performance of firms a long time after their IPOs. Based on the previous research in 1984, Ritter

(1991), Kaneko and Pettway (2003) mentioned firm age as a measure of ex-ante uncertainty and investors' optimism. Older firms often have more public information available; hence lower ex-ante uncertainty. Greater age signals that a firm is well-established and contains less risk.

Underwriter reputation also can be view as a proxy of risk and firm quality. There are many economist examining effects of underwriter reputation on initial performance of newly issued shares such as Logue (1973), Beatty and Ritter (1986), Titman and Trueman (1986). Carter and Manaster (1990) argued that high-ranking underwriter can certify the offer price is consistent with information available and limit the information asymmetry. Therefore, IPOs by reputable investment bank should be less under-priced than those issued by unknown underwriter. However, fewer researchers investigate relation underwriter reputation and long term performance of IPO firms. Carter and Manaster (1998) filled this financial literature gap and found that the greater underwriter reputation, the better performance of company three years after IPOs. The result is consistent to findings of Ritter (1991, 2003); Loughran and Ritter (1995), Jain and Kini (1999). According to the Chemmanur and Fulghieri (1994), in the world of asymmetry information investors do not totally know about investment banks' quality and standards. Thus, investors evaluate investment banks through banks' past performance, which are implied from quality of investment banks' previous clients. From the above explanation, the author argued that underwriters themselves also select good companies to provide service. This implies that companies which have reputable underwriter are good companies and are likely to have better long run performance after their IPOs. This is in contrast with research results of Logue et al (2002) showing that underwriter reputation is unrelated to IPO returns. However, the popular agreement among economists is that privilege underwriters help to reduce information asymmetry, signal high quality of issuing companies and reduce IPO long term underperformance.

Investors usually evaluate the quality of company and its future potential based on some of its signaling factors such as profitability of firm before going

public, dividend projection, financial ratios, etc. Evidences from previous researches of Singh and Whittington (1986), Geroski and Jacquemin (1998), Machin and van Reenen (1993), Khurshed et al (1999) showed that firm profit in period t is highly correlated with profit in period t-1. Signaling hypothesis suggest firms with higher earnings before IPOs should perform better in long run. Firms that are more profitable before time of issuing share continue to be profitable after that and therefore, should have better performance in long run after IPOs.

Investors are also at different risks when having choices of IPOs in different industries. Industries in research of Ritter (1991) have different coefficient with IPO performance in three years after issuing event. The research shows that banking, finance and insurance is the superior industry over the others. IPOs in banking finance and insurance performs the best in three year after IPOs, followed by oil and gas firms. Brown (1999) explained the substantial IPO performance of a certain industry in a specific period of time by the investors' fads towards industries varying through time. This dissertation will examine whether the banking, finance, insurance is still a superior industry in NASDAQ market during 2002-2005 and if investment in long term IPOs in this industry is always a best choice.

Morck and Yeung (1991) posited that multi-nationality adds value to shares with some reasons. First, direct foreign investment occurs when firms can internalize markets for certain of its intangible asset and increase its value. Also, multi-nationality also helps investors to diversify their opportunities via firms' investment abroad. And finally it allows firms to asset low-cost materials and human resource from other countries and reduces tax expenses. Moreover, empirical evidence shows that multi-nationals are larger, more profitable, and spend huge budgets for research and development (Dunning 1973, Morck and Yeung 1991). Khurshed et al (1999) is the first investigating relation between IPO performance in long run and firm multi-nationality. Empirical evidence in the UK market shows that firm multi-nationality have strong positive linkage with market adjusted returns of IPO in three years after their first issuing. Khurshed explained

the relation with risk diversification of multi-national firms and investors' over-optimistic sentiment towards firm scales over geographical areas.

Leland and Pyle (1977) developed a model, in which entrepreneurs want to finance the projects that they better know the true value than outsiders in the condition of asymmetry information. Thus, entrepreneurs' willingness to invest in their own firm signals firm quality. Jain and Kini (1994) provided empirical experience that IPO firms with higher ownership retention of original shareholders generally outperform others both before and after industry effects are adjusted. However, also in the US market, Mikkelson et al. (1997) found no significant relationship between ownership structure and IPO performance both within one year and during first ten years after IPO. Mikkelson and Partch (1985) indicated that loosen ownership concentration reduce the price of listed firms. Khurshed (1999) reported the negative relationship of proportion of equity sold at time of floatation and long-term performance of IPOs. This study will test if ownership retention really signals for good quality company and whether investors can base on the factor to make investment decision in NASDAQ market.

Aiming to test the relationship of firm characteristics and IPO long-term performance in US market and explanations based on signaling theory, the study will use a set of the firm and IPO characteristics. Findings from empirical evidence are valuable for investors to have good choice of IPO long-term investment.

3.2.3. Explanations based on mis-measurement

Factors contributing to mis-measurement are: inappropriate methods of measuring returns, choices of benchmarks, risk adjustment, the methodological aspects of studies of long-run returns. Some researchers such as Ritter (1991), Fama and French (1996), Brav (1997), Barber and Lyon (1997), Kothari and Warner (1997), Gompers and Lerner (2003) found that measurement method, bench-mark and research model have big impact on research's findings.

3.2.3.1. Methods of measuring returns

Different authors have various choices to calculate returns of firms after IPOs. The two most commonly applied methods are Cumulative Abnormal Returns (CARs) and Buy – and – Hold Returns (BHRs). Each has its own limitations that can cause biased statistical problems and badly affect the accuracy of testing results. (Loughran and Ritter, 1995). The BHRs approach has been employed as the appropriate measure of the performance over longer periods in a large number of empirical IPO studies (Ritter, 1991; Conrad and Kaul, 1993, Khurshed 1999). CARs also are used widely such as in studies of Fama (1998), Mitchell and Stafford (2000). Advantages and disadvantages of each method are mentioned in detail in the Methodology chapter.

Raw returns and market adjusted returns used in regression analysis with independent variables also result in difficulties when comparing research results. Take an example, Khurshed (1999) calculates market adjusted abnormal returns of IPO after three years and investigate the relationships of such abnormal returns with firm characteristics. On the other hand, Ritter (1991) uses the raw returns of IPO stock in three years to run regression with other explanatory factors.

Method of measuring returns is still a controversial issue in the literature. Fama (1998) reported that long term underperformance of IPO become insignificant with suitable chosen calculating technique. However, Khurshed (2004) studied the data of IPOs in the UK and found that long run returns are not much different between BHAR calculating method and Fama and French's method.

3.2.3.2. Choices of benchmarks

Different in empirical findings are also explained by the different benchmarks chosen for comparing returns. Different benchmarks chosen lead to different results. Ritter (1991, p. 12) stated that 'the long-run performance of IPOs is very sensitive to the benchmark employed'. Barber and Lyon (1997) mentioned three bench-mark approaches: reference portfolio returns, sample firms with matching

characteristics, and application of three factor model of Fama and French (1993). The research, in which Wolfgang Bessler and Stefan Thies (1994) compared firms long-term returns after IPOs with DAX index and variety of other benchmarks also showed different results. However few studies mention the elements that constitute the appropriate benchmarks employed when evaluating the long term performance of IPOs.

3.2.3.3. Failure of risk measurement

Majority of researches on IPO long-term performance do not adjusted risk when calculating returns of IPO stocks after IPO. Beta of IPO stocks and bench-mark index/ matching firms/ reference portfolio is usually assumed to be zero. This might cause bias to the research results. However, Ritter (1991), Keloharju (1993), Ljungqvist (1995) made an effort to adjust the returns for risk and found no empirical evidence supporting to the mis-measurement of risk adjustment because IPO underperformance still exists.

3.2.3.4. Differences in research perspectives

Some authors use market adjusted returns as the dependent variable in their regression. Ritter (1991) interested in variable such as firm age, firm size, and industry. Khurshed (1999) considered more variables, which are initial IPOs returns, firm size, industry, etc, as researched factors. Different factors in the regression with abnormal returns of IPO may cause difference to the level of significance of each explanatory variable.

Authors also have various choices of research post-event time period. While Khurshed (1999), Ritter (2001), Barber (1997), etc., test IPO long-term performance in three years after IPOs, some other authors examine IPO performance in different time after IPO. For example, on studying performance of IPO in the US, Loughran (1993) tests IPO underperformance 6 years after IPOs, Servaes and Rajan (1997) prefer 5 years as the holding period, Aggarwal and Rivoli

(1990) focus on returns of IPOs within 100 days. Thus, this causes biased once comparing research results of such studies with each other. As empirical evidence, Barber and Lyon (1997) found research findings vary with choices of studied characteristics, time holding period and exchange market.

3.2.3.5. Other mis-measurement

Statistic method is another concern. Many researchers applied traditional testing methods such as t-test or cross sectional testing. Some mention the limitations of t-test as it assumes that contemporaneous observations are independent. Violations of such conditions may lead to mis-specified statistical result. Moreover, Doukas and Gonenc (2005) argued of problem when including in the research IPO sample both firms that issue new shares during three years post IPO and ones with no other issuing.

As discussed above, findings of IPO underperformance phenomenon is subject to mis-measurement. Research results depend on many elements measurement method, chosen benchmark, research models, characteristics to study, stock exchange market, stock market conditions at time of IPO, time scales of research, research holding period, etc. However, those research problems seem to be inherent limitations and difficult to be eliminated.

3.3. Performance measure methods

First, the reasonability of model to calculate IPO's returns is discussed. The most popular model for IPOs returns calculation among financial literature is market adjusted returns model, in which abnormal return is calculated as the difference between the raw returns of IPOs and the benchmark returns. Post event window is usually a month. The benchmark returns are of a broad share price index.

The excess actual return over the capital asset pricing model-determined expected return market is called an 'abnormal return'.

$ar_{it} = r_{it} - r_{mt}$

r_{it} is the returns of IPO stocks in month t

r_{mt} is the returns of the market bench-mark in month t

An advantage of the model is its simplicity, however it has some limitations. In the context of traditional CAPM, to make it simple this study assumes beta of every stock and the bench-mark index is one as in most of papers studying on IPO long term performance. Brown (1999) found that market adjusted return model does not represent accurately the conventional portfolio theory, in which there are cross sectional variations among shares' expected returns. This simplified model implies that the expected returns of any IPO firms and of the benchmark portfolio are the same. That means there is no adjustment for systematic risk (Levis 1999, Brown 1999). Despite some limitations of the market adjusted return model, many researchers still believe that the assumption of unitary beta coefficient does not have a serious biased effect on the results in the market adjusted return model. Ritter (1991), Keloharju (1993), Ljungqvist (1995) attempted to calculate risk adjusted returns for IPO stocks and found empirical evidence supporting to the mis-measurement of risk adjustment because there still exist IPO underperformance. Ibbotson (1975), Clarkson and Thompson (1990), Ritter (1991) supported the model with Beta 1 with argument that the average betas decline over length of time after IPO and the difference in betas becomes too small to have any significant effect on the results (Khurshed et al 1999).

On the other hand, there are other ways to estimate expected return of IPO portfolio but they are much more complicated. In modern CAPM, the share expected return can be predicted based on its positive relationship with the covariance of share price and price of market index. Some authors such as Espenlaub et al (2000) attempt to estimate the CAPM beta using post price data but this procedure requires extra data. Ibbotson (1975), Levis (1995) researched CAPM in IPO and found that beta coefficients may change over time.

Brown (1999) argued that there is not equilibrium model of asset price with enough empirical evidence; any model is an imperfect description of reality. An amount of measurement error is inevitable; however, the market adjusted returns model is the one which has the least inaccurate subsequent hypothesis. Evidences supporting for the market adjusted returns model are also provided by Brown and Warner (1980), Barber and Lyon (1997). Therefore, the simple method of estimating IPOs abnormal returns, the market adjusted return model is as good as more complicated models and is popularly applied in researches of IPOs performance.

Second, I would like to discuss options of return measurement method. As discussed in 2.3.3, measurement method is important because it directly impacts the long term return anomalies and the research findings. Which measurement method is more empirically adequate is still a controversial issue in the literature of IPO performance research. The two most popular methods, Cumulative Average Returns (CARs) and Buy and Hold Returns (BHRs). Cumulative abnormal returns is sum of monthly abnormal returns while buy and hold abnormal returns is the compound return on a sample firm less the compound return on a reference portfolio. Each method has its own merits and limitations. Kothari and Warner (1997), Barber and Lyon (1997), and Lyon, Barber and Tsai (1999) researched on different methods for measuring IPO abnormal returns but they failed to draw conclusion of the best measurement method.

Fama (1998), Mitchell and Stafford (2000) are among authors in support of CARs measurement method. Their evidence showed that BHRs method may cause more skewed returns and magnify the IPOs underperformance over the reality than CARs. The skewness magnitude is more serious with longer holding period of returns. Therefore, the author implied that papers which include time series regressions should use CARs instead of BHRs.

On the other hand, many other researchers documented better performance of BHRs method over CARs. Ritter (1991) was among the first to define the different uses

of BHRs and CARs when considering the case of a 12 month CAR and an annual BHRs. He concluded that to test null hypothesis 12 month CAR is zero, means to test the null hypothesis of the zero mean of monthly abnormal return of the sample firms during a certain year. This is quite different from a test that null hypothesis BHR is zero, which means annual abnormal return equals zero. Barber and Lyon (1997) showed that CARs is not the adequate measurement method of returns for long holding period because this cause much biased to the returns generated by CARs. BHRs compound every short term return to calculate the long term return, thus cause much less biased and give more accurate results. Brown (1999) supported the argument and further stated that BHRs are more closely refer to the understanding of long term abnormal returns. Gompers and Lerner (2003) also backed for BHRs measurement method, finding that CARs usually depend on choice of trading strategies. Conrad and Kaul (1993) found upward bias tendency of the long run returns calculated according to CARs method, but not from BHRs measurement.

Moreover, CARs are less appealing statistics than BHRs because they require frequent portfolio balancing. The cumulative average abnormal return CAR over T months is sum of average abnormal returns over IPOs in the sample during the period. From definition of CAR, it is implied that the portfolio rebalanced to equal weights at the end of every month. To make sure the rebalancing state of the portfolio, at that time some winning stocks should be extracted and other loosing stocks should be added. (Brown 1999)

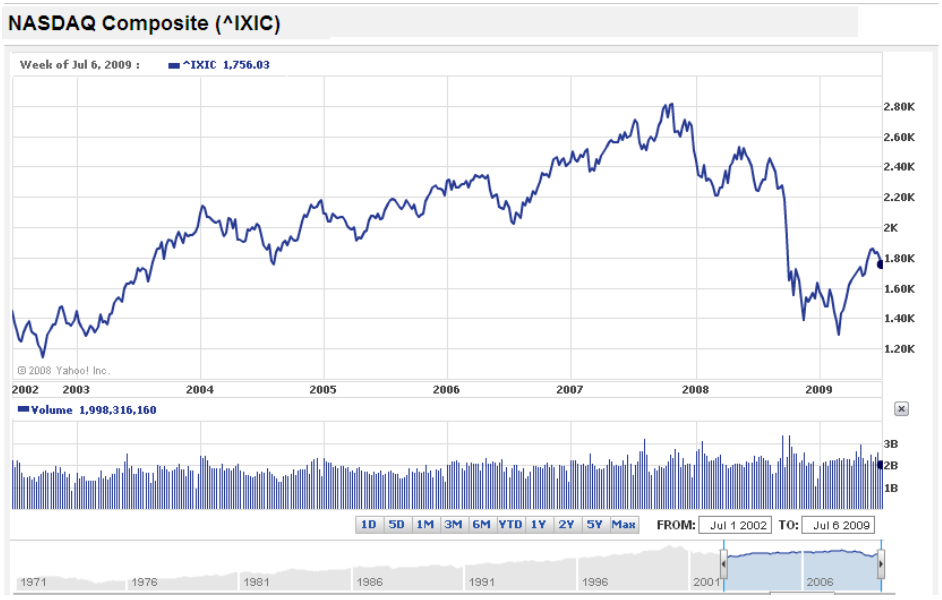
All in all, based on the conceptual perspective and advantages of the method discussed above, BHRs method is proved to be more attractive statistics and will be used as method of returns calculation.

CHAPTER 4: DATA COLLECTION

4.1. Data selection

NASDAQ stock market experienced a continuous growth period from 2002 to first half of 2008 before its plunge in late 2008 (See NASDAQ Composite Index price over time in Figure 3). To avoid the impact of a sudden severe drop of the stock market on to the research result, this study focus on the performance of initial public offerings in NASDAQ stock exchange market from 6/2002-6/2005 in three years post IPO.

Figure 3: NASDAQ Composite Index during 6/2002-6/2009



Source: yahoofinance. Com

IPOs included in the study should satisfy requirements as described below.

- Only accept IPOs, not other means of floating such as readmission, transfer from other shares, etc.
- IPOs of companies without takeover or mergers during *3 years* after IPOs

- The IPOs are of US based companies
- Only IPOs traded on USD
- Only issues with common stock are included. In other words, preference issues, warrants, options or other financial instruments are eliminated from the sample.
- Not accept closed-end funds and unit trust. Because it is well accepted by majority IPO studies that their institutional characteristics of large size offerings and low risks will significantly bias the empirical results.
- Not accept stocks which are transferred from or transferred to other countries or other US stock exchange during three year period after IPOs. Stocks transferred between tiers on NASDAQ stock exchange such as Global Selected Market, Global market, Capital Market within three years post IPO are accepted.

4.2. Data collection

This study focuses on NASDAQ stock exchange during 6/2002-6/2005. Data is collected from the IPO centre data base of MSN website[1] and double-checked in NASDAQ official website[2]. The website provides details and information of 183 IPOs in NASDAQ during research period. After excluding trusts, investment funds, foreign companies listed in the US stock market and companies not satisfying other selection requirements, 107 companies are included in the research sample. Details of these companies for research purposes are collected from different sources. Initial offer price, firm industry, number of shares offered, lead underwriter are collected from company prospectus. Prospectus is taken from the financial MSN website[3]. Share price on first trading day and after that are collected from Yahoo-finance website.[4] Standard Industry codes, diversity of company are obtained from the prospectus of firm and brief profile of firm on Yahoofinance.com. Underwriter

[1] http://moneycentral.hoovers.com/global/msn/index.xhtml?pageid=10021.
2 http://www.nasdaq.com/

3 http://moneycentral.hoovers.com/global/msn/index.xhtml?pageid=10021.

4 http://uk.finance.yahoo.com/

reputation ranks are taken from Ritter's IPO Underwriter Reputation Rankings (1980 - 2007)[5]. Other research factors are calculated from original data as follows.

Returns of first trading day are calculated based on close price of first trading day and initial offer price.

Firm size has proxies: Gross proceeds, firm total asset, and market capitalization.

- Gross proceed = Number of Shares * Offer price
- Firm total asset is average total asset of firms during 3 years before going public
- Market capitalization value = Number of Shares * Close price in first trading day

Firm age = Year of IPO – Year of establishment

Firm's earning is the average of earnings of firm in three years before its flotation. Earnings in every year are obtained from prospectus of companies.

Portion of equity sold at the time of offering is the ratio of number of shares sold at the time of initial offerings and total shares of firm

Data details are presented in Appendix 6.

[5] http://bear.cba.ufl.edu/ritter/ipodata.htm.

CHAPTER 5: METHODOLOGY

The study investigates the IPO long term performance in NASDAQ global market with the focus on firms' pre-IPO financial performance and IPO characteristics. One of the goals of the study is to compare findings to previous researches such as Ritter (1991), Khurshed et al (1999) and contribute to literature of IPO long-term underperformance. Therefore, first the study attempts to investigate underperformance phenomenon of IPO in long run and compare results to findings in Ritter (1991). Second, cross-sectional analyses on firm age, gross-proceeds, industry are conducted in similar way as Ritter (1991). Based on expected hypotheses and results of cross-sectional analysis, the study will do regression between IPO long-term abnormal return and similar set of factors as in Khurshed et al (1999) to explore relationships of IPO long-term performance and firm characteristics. Furthermore, some other variables such as another proxy for firm risk - market capitalization, stock volatility, and volume of IPO at the time of stock floatation are also added to test the theories analyzed in the literature review. This chapter will describe measurement and methodology applied to perform the two above tasks.

5.1. Performance measurement

The market adjusted return model is used to measure abnormal return of each IPO, both initial trading day returns and returns in three years post event window after IPOs.

5.1.1. Initial abnormal returns

The market adjusted abnormal return for each IPO on the first trading day is computed as:

$$\boldsymbol{MAAR_{i,0} = [(1 + R_{i,1})/(1 + R_{m,1})] - 1}$$

In which:

- The total return for stock 'I' at the end of the first trading day is calculated as:

$$\boldsymbol{R_{i,1} = \ln(P_{i,1}/P_{i,0})}$$

$\boldsymbol{P_{i,1}}$ is the price of stock 'I' at the end of first trading day

$\boldsymbol{P_{i,0}}$ is the initial offering price

$\boldsymbol{R_{i,1}}$ is the total return at the end of trading day of stock i

- The return on the market benchmark during the same period (one-day event window) is calculated as:

$$\boldsymbol{R_{m,1} = \ln(I_{m,1}/I_{m,0})}$$

$\boldsymbol{I_{m,1}}$ is the market index (NASDAQ composite index) value at the close of first trading day

$\boldsymbol{I_{m,0}}$ is the market index value on the offer day of the stock

$\boldsymbol{R_{m,1}}$ is the first day's comparable market return

5.1.2. Long-term abnormal returns

The IPO long term performance is calculated as the market adjusted returns for a period of 36 months following the first trading month. IPO under-pricing is a popular phenomenon on the market. The goal of not including the first day of trading in the study is to abandon the effect of investors' over-optimism, firms' earning management and underwriters' price supports on IPO long run performance. It is believed that after one month such effect would be eliminated and share price would become nearer to its market equilibrium. The choice of 36 months (three-years) as the post event window period in IPO long term performance measurement is also consistent with many other previous researches of IPO long term performance such as Ritter (1991), Levis (1993), Esplenlaub et al (2000). Some other authors chose five years as the holding period for research such as Ibbotson (1975). However, the choice of three-year holding period is considered more appropriate in this study because measurement error in abnormal returns calculation is larger in the expansion of chosen research holding period as stated in Brown (1999)'s paper. Moreover, during such long period after the IPO longer holding period, some issuing firm may go bankrupt or have merger and acquisition. Also, there are new listed and delisted stocks on the market, which is taken as the benchmark of the studied portfolio. These may cause bias to the study.

There is no clear definition of 'the end of the month' in Khurshed et al (1999)'s IPO long term performance research. If the end of the month is understood as the last day of calendar month, the first month's returns of stocks are in fact measuring the returns of stocks in different time rather than 30 days after their IPOs. Number of days included as a month to calculate first month's IPO returns of two stocks will be very different if one goes public at the beginning a month and the other is floated at the end of a month. Take example of stock A, which is floated on 3/1/03 its first month's return is taken on 30/1/03; the return calculated is within 27 days. Stock B is floated on 27/1/03; its first month's return should be also taken on 30/1/03. The return calculated is within only 3 days.

Accordingly, second month's return of stock A is in fact taken 57 days after IPO instead of two months and second month's return of stock B is taken only 33 days after its IPO. Monthly returns of stocks are taken and treated differently as such may cause bias to the study. Therefore, the study prefer Ritter (1991)'s method to count days for a month. Ritter (1991) consider 21 continuous trading days as a trading month. However, due to time limitation of the dissertation, the study considers 30 consecutive days as a month to calculate stock returns instead of 21 trading days as Ritter (1991). Although such method is not efficient as that of Ritter, it reduces the time bias as in research of Khurshed (1999).

As supported by many researchers and analyzed in the literature review part, BHRs measurement method is proved to be more statistically appealing and appropriate in this study of IPO long-term performance than other methods such as CARs. Moreover, BHRs application is consistent to Khurshed et al (1999). Therefore, this study focuses on using BHRs as the main long term performance measurement method. The returns of the IPO sample in the three year holding period are calculates as:

$$\boldsymbol{MABHR_i} = \sum_{t=2}^{t=37} [\ln(\boldsymbol{P_{i,t}}/\boldsymbol{P_{i,t-1}}) - \ln(\boldsymbol{I_{m,t}}/\boldsymbol{I_{m,t-1}})]$$

MABHRi is the market adjusted buy and hold return for share 'I' over 37 month trading period, (the first month is excluded, instead, 36 months are calculated from 2nd month to 37th month)

$\boldsymbol{P_{i,t}}$; $\boldsymbol{P_{i,t-1}}$ are the price of share 'I' at the end of month t and month t-1 respectively

$\boldsymbol{I_{m,t}}$, $\boldsymbol{I_{m,t-1}}$ are the index value at the end of month t and month t-1 respectively

There are both advantages and disadvantages in every measurement metrics. Although BHR method is considered to be more suitable in this research, it is worthy to apply the two methods and compare the findings. The inherent limitation will be discussed in the limitation part for further research in the future.

As suggested in the literature review part, the choice of market benchmark has a big impact on the study's findings since it forms an important part in the computation of IPO long term abnormal returns. There are three tiers in NASDAQ stock exchange. They are NASDAQ capital market, NASDAQ Global Market and NASDAQ Global selected Market with specifications and characteristics introduced in chapter two. Main indices in NASDAQ market are NASDAQ 100, NASDAQ Financial index, NASDAQ Biotechnology index and NASDAQ composite. The study research IPOs on NASDAQ stock exchange as a whole. NASDAQ-100 is a modified market value weighted index, consisting 100 largest non-financial companies listed in NASDAQ. NASDAQ Biotechnology index includes only stocks of biotechnology industry, which makes it biased if this index is compared to performance with performance of IPOs in NASDAQ global market. The Nasdaq Composite is an index of all of the common stocks on the NASDAQ stock market. When considered all NASDAQ stock indexes, NASDAQ Composite Index is the most appropriate benchmark index in this study.

5.2. Hypotheses

In this section based upon the explanatory theories discussed in Chapter 3, explanatory variables will be chosen and discussed in relationship with IPO long-term performance. Also, relationships between every explanatory variable and IPO market adjusted returns will be developed into hypotheses. These hypotheses will then be divided into groups in order to develop models for regression tests in the next section. [6]

5.2.1. Initial returns and IPO long-term performance

Theories of investors' over-optimism have been used to explain IPO long-term underperformance. Diversion of opinions hypothesis states that exciting emotions of a group of investors towards IPOs leads to high abnormal IPO initial returns. Prior-IPO earnings management, which shows firms' higher future potential, partly contributes to investors' trading excitement. When such emotions pass, IPO stocks should return to their intrinsic value. As for underwriters, they tend to under-price IPOs to assure IPO success and their prestige. Due to under-pricing, investors assume better initial performance of IPOs compared to the whole market. Such 'free lunch' profits from under-pricing phenomenon attract lots of investors to IPOs and create an exciting sentiment to other investors and the whole market. This in turn increases IPOs initial abnormal returns again. IPO stocks will underperform the market as soon as firms' subsequent returns disappoint

[6] Note: Khurshed (1999) investigated the variable COST, which is the portion of the total direct costs of going public over funds raised in IPOs (i.e. gross proceeds). The flotation costs includes mainly commissions for underwriters, which represents firm quality and other costs incurred by the the IPO companies in the offerings such as legal fee and auditing fee, which depends on the offer size (Merrett et al 1967). Khurshed argued that dividing the total direct cost to the offer size, variable COST as the portion proceeds will contain only the element representing firm quality. In fact COSTs of most US IPOs are almost the same. This makes the regression of variable COST with dependent variable 3 years holding period abnormal returns become statistically meaningless. As a consequence, this study does not include the variable COST in the regression

overoptimistic investors. The more over-optimistic investors are towards IPOs, which is implied by higher initial returns, the worse IPO long-term performance. Ritter (1984), Khurshed (1999) documented the negative relationship between initial return and IPO performance after three years. Similarly, the dissertation attempts to test over-optimism theory through the relationship of IPO initial returns and its long-term performance with the holding period of three years. Initial abnormal returns of IPO (MAARi) are expected to have negative coefficient with IPO long term abnormal returns.

Hypothesis 1

Ho: There is no relationship between the initial market adjusted returns and the three year Buy and Hold Returns of IPOs

H1: There is a negative relationship between the initial market adjusted returns and the three year Buy and Hold Returns of IPOs

5.2.2. 'Hot issue market' and IPO long-term performance

Supporting for the over-optimism of investors in very first days of trading after IPO, Ritter (1991), Ljungqvist et al (2006) presented a model of 'hot issue market', in which investors are more excited about stock trading than in other period of time. Ljungqvist et al mentioned individual investors with optimistic sentiment create the motivation for a hot issue market. Similarly, Derrien (2005) explained hot issue market with the roles of 'noise traders'. IPO volume is used as proxy for 'hot' market. Market is considered to be 'hot' on periods with strikingly high volume of IPOs. Ritter (1991) included raw returns of IPOs in three years post event as dependent variable and IPOs volume per year as independent variable in his research. However, this research just focuses in a shorter time (2002-2005) to investigate IPO long-term performance in NASDAQ , hence it is not feasible to apply Ritter (1991)'s regression. To aim at testing the explanatory theory for IPO long-term underperformance based on 'hot issue market' in NASDAQ during 2002-2005, the study simply divides research period into two sub-periods with highly different

IPO volumes and use a dummy variable VOL for IPO volume. The higher volume of IPOs, implying the hotter the market, the poorer long-term IPO is expected to be. This will be described in details in model specifications part.

Hypothesis 2

Ho: There is no relationship between IPOs' volume and the three year Buy and Hold Returns of IPOs

H1: There is a negative relationship between IPO's volume and the three year Buy and Hold Returns of IPOs

5.2.3. Firm size and IPO long-term performance

The literature finds that firms' size before their IPOs and long run performance after IPOs have a positive relation. Bigger firms have tendency to get better performance a certain time after they go public (Ritter 1991, Levis 1993). There are some factors that have been used as proxies for firms' size such as gross-proceeds (Levis 1993; Khurshed et al 1999, 2007); net assets (Khurshed 1999, 2004) and market capitalization value (Gounopoulos et al 2007). Gross-proceeds (GROSSPROCEEDs) refer to the total amount of money raised from the initial public offerings. It is believed that the bigger firms, the larger issue they float in their IPOs, which leads to the greater gross proceeds. However, there is still the case: a given firm chooses to raise a larger amount of funds in good market condition when investors are optimistic towards the stock market in general and have strong demand of firms' shares in particular (Ritter 1991). To be prudent, the study adds in two other variables, which are net assets (ASSFLOAT) and market capitalization of firm at the offering time (MCAFLOAT) as the proxy of firm size. The capitalization is added to test because in some cases the variable gross proceed can be inaccurate to present firm size such as large firm with small issue and small firm with large issue.

Hypothesis 3

Ho: There is no relationship between firm size at the flotation time and the three year Buy and Hold Returns of IPOs

H1: There is a positive relationship between firm size and the three year Buy and Hold Returns of IPOs

5.2.4. Firm age and IPO long-term performance

Many studies have used firm age as a proxy for risk of IPO firms. Ritter (1984), Carter et al (1998), Ritter (1991) found that younger firms experienced more severe underperformance in the long run after IPO and explained this using over optimism theory. The paper of Khurshed (1999) used variable DURATION as firm age DURATION gives the age of a firm (in days) from the date of incorporation to the day of listing'. The study also uses AGE as firm age and expects a positive relationship between firm age and IPO long term performance

Hypothesis 4

Ho: There is no relationship between firm age at floatation time and the three year Buy and Hold Returns of IPOs

H1: There is a positive relationship between firm age at floatation time and the three year Buy and Hold Returns of IPOs

5.2.5. Firm Earnings before IPOs and IPO long-term performance

Evidences from previous researches of Singh and Whittington (1986), Geroski and Jacquemin (1998), Machin and van Reenen (1993) show that a firm with good performance before IPO is highly likely to continue performance well after its flotation. According to signaling hypothesis, relation between IPO long-term performance and average firm earnings three years before floatation is expected to be positive. However, Khurshed et al (1999) found the opposite relation of IPO post performance and firm earnings in the last year before IPO. This

can be explained by the earnings management hypothesis, which states that firm earnings before IPO can be inflated. As a consequence, in the long run such firms cannot meet investors' expectation and underperform other stocks. Average of earnings in three years is taken to avoid possible effect of earnings management. Variable AVERINC, which is firm's average earnings for the last three years before their IPOs is added in the progression with firms' long term abnormal returns. AVERINC is expected to have a positive coefficient with MABHRs.

Hypothesis 5

Ho: There is no relationship between firm's average earnings for the last three years before their IPOs and the three year Buy and Hold Returns of IPOs

H1: There is a positive relationship between firm's average earnings for the last three years before their IPOs and the three year Buy and Hold Return of IPOs

5.2.6. Underwriter reputation and IPO long-term performance

Previous researches documented the relation of underwriter reputation for firm's IPO and its long run performance. The more privilege IPO underwriter is the higher quality of the offering. So, better underwriter reputation signals better performance of firm in the long run. Carter et al (1998), Jain and Kini (1999), Khurshed (1999, 2004) documented the experience of this positive relation of underwriter reputation and firm long run performance after IPO. This study includes underwriter reputation as an analyzing variable, which denotes by UNDERWRITERANK. Rankings of underwriters are obtained from Ritter's data. Underwriter rankings from this source and IPO returns are not strongly linear. Aiming at exploring the effect of the most privilege underwriters on IPO long-term performance in comparison to the rest underwriter, dummy variable UNDERWRITERANK is used instead. UNDERWRITERANK equals to 1 if the underwriter name listed in rank more than 8 in the data of underwriter rankings

and takes the value of 0 otherwise. Underwriter rank is expected to positively relate to IPO long-term performance. [7]

Hypothesis 6

Ho: There is no relationship between underwriter reputation and the last three years before their IPOs and the three year Buy and Hold Returns of IPOs

H1: There is a negative relationship between underwriter reputation and the three year Buy and Hold Returns of IPOs

5.2.7. Volatility of IPO stocks and IPO long-term performance

Schwarz et al (1985) gave explanation for 'fads' by the nature of IPO investors, less risk-averse and more speculative than other groups of investors. They accept higher level of price volatility and larger deviations from share intrinsic values. This study will examine whether risky IPO investors receive more earnings from IPOs in NASDAQ stock exchange during 2002-2005. A positive relationship between risk of IPOs stock measured by variance (volatility) of stock returns (STDEV) and long-term abnormal returns of IPOs is expected.

Hypothesis 7

Ho: There is no relationship between volatility of IPO stocks and the last three years before their IPOs and the three year Buy and Hold Returns of IPOs

H1: There is a positive relationship between volatility of IPO stocks and three year Buy and Hold Returns of IPOs.

[7] Note that in Carter et al (1998), underwriter rank is classified into three groups: low (rank 0-3), medium (rank 3-7), high (more than 8). However, for our data, there are not many of firms with low-ranking underwriters. Therefore, we combine underwriters with low ranks and medium ranks into one group. Underwriters are grouped into two groups: low - medium rank and high rank.

5.2.8. Firm multi-nationality and IPO long-term performance

According to Khurshed (1999), multi-nationality signals for quality and reputation of firm. He found that stocks of multi-national companies outperform stocks of domestic ones in three year after IPO. Khurshed et al (1999) considers firms as multi-national if they have subsidiary in one of the major geographical areas including UK, Europe, North America, South America, Africa, Australia, Asia. In Khurshed (1991) GSCOPE represents for multi-nationality of firm and takes the value from 1 to 7, depending on how many regions the firm have subsidiaries in. As for the IPO sample in this study, efficient information of firms' subsidiary allocation is difficult to obtain. This study adjusts Khurshed's definition of multi-nationality, dummy variable MULTINATIONAL is used. Following the multi-nationality definition of Morck and Yeung (1991) in their research, firms with five or more subsidiaries are considered to be multinational.

Hypothesis 8

Ho: There is no difference of the three-year Buy and Hold Returns of IPOs stock of multinational firms and that of the rest

H1: The more multinational a firm is; the better is the IPO long-term performance.

5.2.9. Firms in Banking, Finance, Insurance industry and IPO long-term performance

Ritter (1991) and Levis (1993) investigate performance of IPO stock in different sectors in US and UK market. The findings show that IPOs in banking, finance, insurance outperformed the rest. As mentioned before, this study will test if IPOs in the industry still best performed on NASDAQ stock exchange during 6/2002-6/2005. Dummy variable SPECINDUSTRY is an explanatory factor in the regression, it takes value of 1 if firms are in banking, finance, and insurance industry and equals zero otherwise.

Hypothesis 9

Ho: There is no relationship between firm in banking, finance, insurance industry and the last three years before their IPOs and the three year Buy and Hold Returns of IPOs

H1: There is a positive relationship between firm in financial service sector and the three year Buy and Hold Return of IPOs

5.2.10. Portion of equity sold at the time of offering and IPO long-term performance

Jain and Kini (1994), Mikkelson et al. (1997), Khurshed et al (1999) have investigated the relationship between ownership retention and long-term performance of IPOs and provide various results as mentioned in the literature part. According to asymmetry information hypothesis, firm owner prior to IPO know their firm better than outsider investors. Following signaling theory, ownership retention, which is insiders' commitment, signals firm quality. This study will retest the influence of proportion of ownership retained after IPOs on IPOs' market adjusted returns in three years after issuing event on NASDAQ market. Following suggestion from previous empirical experience in Jain and Kini (1994), Khurshed et al (1999), portion of equity sold at the time of offering (EQUISSUE) and abnormal returns of IPOs in three years after IPOs are expected to have negative relationship.

Hypothesis 10

Ho: There is no relationship between firm in portion of equity sold at the time of offering and the last three years before their IPOs and the three year Buy and Hold Returns of IPOs

H1: There is a negative relationship between portion of equity sold and the three year Buy and Hold Returns of IPOs

5.3. Model Specifications

From the above hypothesis of relationships between IPO long term abnormal returns and IPO and firm characteristics, eight models are developed. Dependent variables are grouped following Khurshed (1999). Also, variable 'VOL' is added in model 2 to test the 'hot issue market' in NASDAQ stock exchange during 2002-2005. To be prudent, another proxy for firm size – market capitalization is included following Gounopoulous (2007) in model 3. In model 5, variable STDEV- which is standard deviation of IPO stock returns, is added to test the relationship between IPO stocks' volatility and their long term performance. Due to the characteristics of data, some variable in regression models in Khurshed et al (1999) have been adjusted and transformed to satisfy the assumptions of OLS regression.

1/ Model 1

Model 1 is designed from hypothesis 1 to explore linkage of initial market adjusted returns and long-term returns of IPOs and test over-optimism theory in NASDAQ market.

MABHRi = α0 + α1MAARi + ei **(Model 1)**

MAARi is initial abnormal return of IPO, calculated as in 5.1.1

MABHRi is long term abnormal return of IPO, calculated as in 5.1.2

2/ Model 2

Model 2 is developed from hypothesis 2 is to check the affect of 'hot issue market' phenomenon to the three year holding period market adjusted returns of the IPOs. Proxy of 'hot issues market' is the IPO volume in a certain period of six months. IPO market in NASDAQ stock exchange is considered as 'cold' during the period 7/2002-6/2003, when IPO volume was very low. 'Hot market' is identified

during 1/2004-6/2005 when average more than 20 firms went public every six months. Dummy variable *VOL* is created. VOL is assigned the value 1 as an IPO is performed in 'cold' period and take value of zero otherwise.

MABHRi = α0 + α1MAARi + α2aVOL + ei **(Model 2)**

In model 2 dummy variable Vol is believed to affect the intercept of the regression line only. The coefficient α2 represents the difference in MABHRi of IPOs when their initial market adjusted returns are zero.

Model 2b is applied in case that the IPO initial market adjusted returns has different influence on IPO long-term performance in different time of IPO, dependable on whether a firm goes public in 'hot' or 'cold' period. α2 reflects the IPO issuing period difference on initial market adjusted returns in IPO long-term performance.

MABHRi = α0 + α1MAARi + α2Maarvol + ei **(Model 2*)**

In which: MaarVol= MAARi* Volume

Among the two models, the better will be chosen.

3/ Model 3

Model 3 investigates relationship of IPOs long term performance and firm size. First, different proxies for firm size are included. Proxies for firm size: Gross-proceeds (GROSSPROCEEDs); total assets (ASSFLOAT); market capitalization (MCAFLOAT).

MABHRi = α0 + α1MAARi + α2Maarvol + α3 GROSSPROCEEDsi + α4 MCAFLOATi + α5 ASSFLOATi + ei **(Model 3)**

After run regression, the most significant proxies will be chosen to present for firm size, other proxies will be deleted. In case of nonlinear relationship between MABHRi and GROSSPROCEED/ MCAFLOATi/ ASSFLOATi natural logarithm of the variables will be taken to create new variables as replacement.

4/ Model 4

Model 4 examines relationship of firm risk and quality and IPO long-term underperformance in the long run. The explanatory variables (firm age, earnings before IPOs, underwriter reputation) representing for firm risk and quality are similar to those in Khurshed (1999). Model 4 illustrates for hypothesis 4, 5, 6.

MABHRi = α0 + α1MAARi + α2 SIZEi + α3 RISKi + ei OR

MABHRi = α0 + α1MAARi + α2 MAARVOL + α3 GROSSPROCEEDS + α4ASSFLOATi + α5 MCAFLOATi + α6 AGEi + α7 AVERINC+ α9 UNDERWRITER REPUTATION + ei **(Model 4)**

After run regression, the most significant proxies will be kept, others will be deleted in model 4*.

Note that to make sure the linear relationship between dependent variable and independent ones, Ritter (1991) used LOG (1+age) instead of AGE; following Ritter (1991) if it is necessary. Results part will describe the adjustments further.

5/ Model 5

Model 5 is developed from hypothesis 7, aims at testing the relationship of IPO long-term performance and volatility of stocks in NASDAQ market during 6/2002-6/2005. In model 5, variable STEV is added. STEV is the volatility of IPO stock, calculated as the standard deviation of stock returns.

MABHRi = α0 + α1MAARi + α2 MAARVOL + α3 ASSFLOATi + α4 MCAFLOATi + α5 AGEi + α6 AVERINC+ α7 UNDERWRITER REPUTATION + α8 STDEV+ ei (**Model 5)**

6/ Model 6

Model 6 is developed from hypothesis 8 to test the relationship of IPO long-term performance and firm multi-nationality (MULTINATIONALITY). As mentioned in

hypothesis 8, MULTINATIONALITY in this study is slightly different from that in Khurshed (1999) and receives value of 1 if firms have not less than five subsidiaries.

MABHRi = α0 + α1MAARi + α2 SIZEi + α3 RISKi + α4 MULTINATIONALITYi + ei **(Model 6)**

7/ Model 7

Model 7 is designed from hypothesis 9 to examine the influence of the special industry – the industry of banking, finance and insurance to IPO long-term performance. Dummy variable SEPECINDUSTRY will takes value 1 if firms are in banking, finance and insurance industry and value 0 otherwise.

MABHRi = α0 + α1MAARi + α2 SIZEi + α3 RISKi + α4 MULTINATIONALITYi + + α5 SPECIAL SECTOR dummy + ei **(model 7)**

8/ Model 8

Model 8 is developed from hypothesis 10 to test the relationship between IPO underperformance and ownership retention. EQUISSUE is the proportion of equity sold at the time of floatation.

MABHRi = α0 + α1MAARi + α2 SIZEi + α3 RISKi + α4 MULTINATIONALITYi + α5 SPECIDUSTRY + α6 EQUISSUE+ ei **(model 8)**

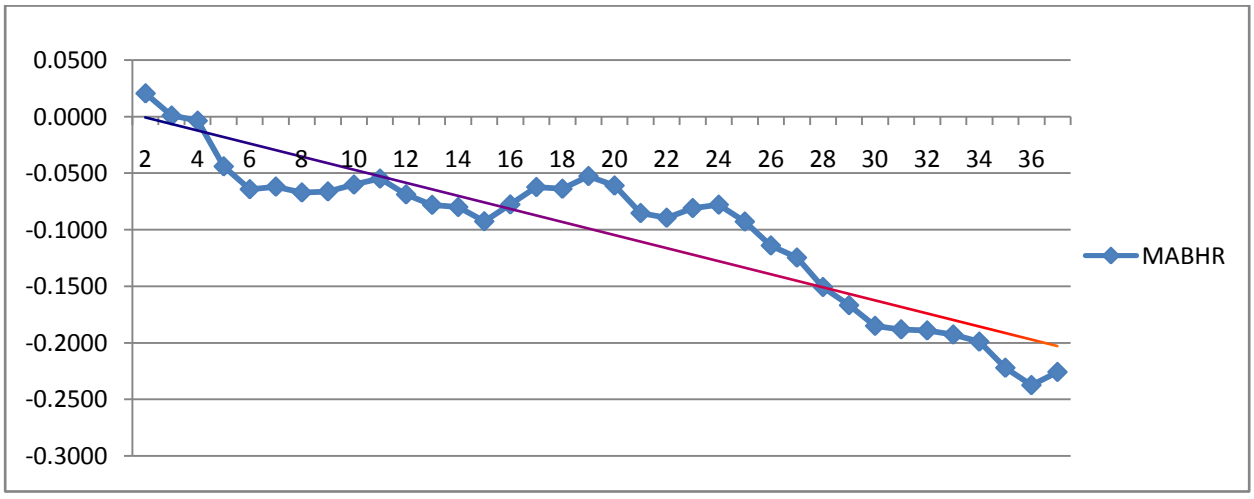
CHAPTER 5: RESEACH RESULTS

In this chapter, first the study provides evidence of IPOs underperformance in NASDAQ stock exchange during 2002-2005. Second, cross-sectional analysis is conducted and results are then compared with Ritter (1991). In the descriptive analysis, relations between explanatory factors and IPO long-term performance are explored and seem to be consistent to the hypotheses developed from financial literature. Finally, this chapter presents quantitative and statistics results from regression analysis. Conclusion about influence of IPOs and firms characteristics on IPO long-term performance and advices to investors will also be withdrawn.

5.1. Post IPO performance

Empirical evidence in NASDAQ stock exchange during 2002-2005 confirms underperformance of initial public offerings stocks in long term. There are some fluctuations in movement of the market adjusted returns; however, the declining trend is very clear during the three-year period. The equally weighted market adjusted returns of the sampled portfolio over 1-36 months after the IPOs is illustrated in figure 4.

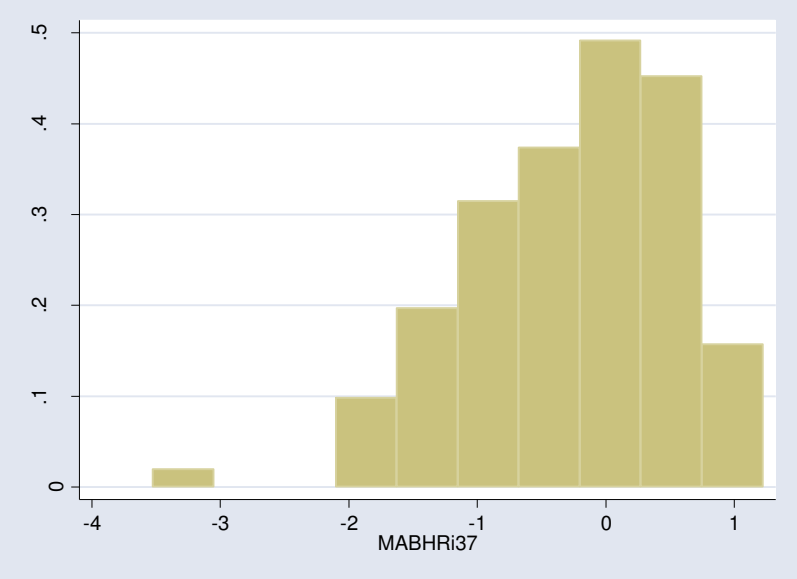
Figure 4: 1-36 month MABHR of Sample Portfolio



The IPO sample only outperforms the NASDAQ composite index for two months. After that, it steadily underperforms the market. Adjusted market returns of sample IPO rebound from month 17th to month 25th but experience a further decline from month 27th to month 36th post IPO. The underperformance of the NASDAQ IPO sample during 6/2002-6/2005 is consistent with Ritter (1991)'s previous findings of IPO underperformance of IPO stocks in US market.

Figure 4, in fact, only displays movement of average of IPO market adjusted returns. T-test statistic is used to compare mean of the portfolio with zero. Significance of negative mean of the portfolio sample will prove the underperformance of IPOs portfolio in comparison to NASDAQ market index. Before applying t-test to compare abnormal returns of the sampled portfolio with zero, the study checks skewness of the abnormal returns portfolio. Regretfully, the market adjusted returns of the portfolio are not normally distributed. Take the portfolio's abnormal returns on the 37th month after IPOs as an example.

Figure 5: Distribution of IPO market- adjusted returns in month 37 post IPO

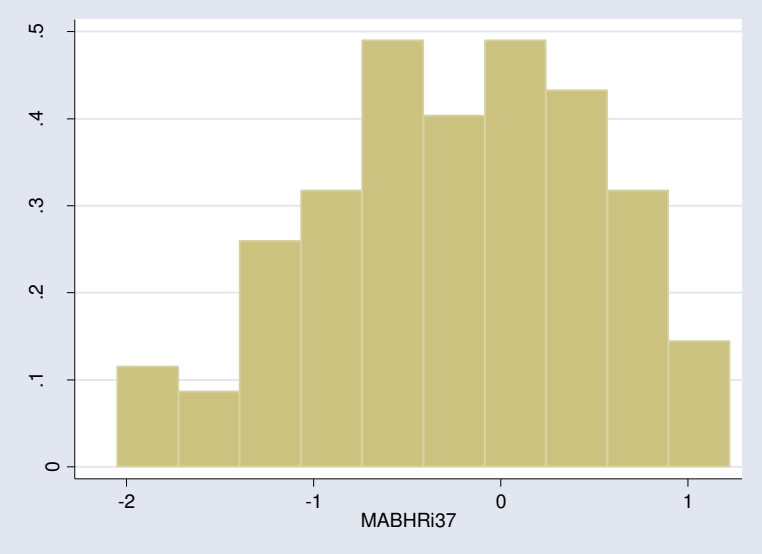


The histogram of MABHRi37 shows the negative distribution of the abnormal returns. The left tail is longer than the right one. Bigger part of the distribution is on the right of the histogram. As a result, median of MABHR is greater than its

mean. T-test statistic on one population mean is under the assumption that the population is normal distributed. The result will be inaccurate if this assumption is violated. However, as it is very clear in the histogram, there is an outlier, which contributes to most of the skewness in the distribution. To make sure the accuracy of the t-test, the study deletes the only outlier from the portfolio. After the outlier is deleted, abnormal returns of the portfolio are considered as normal distribution. Again take the MABHRs in the 37th month after IPO as an illustration.

Figure 6: Distribution of IPO market- adjusted returns in month 37 post IPO

After deleting the outlier



Two tails of the distribution of MABHRs after taking out the outlier are fairly equal. To be prudent, Skewness and Kurtosis normality test is taken. P-value is 0.1157. The insignificant of the test means that the hypothesis of normal distribution of variable MABHRi37 is not rejected. Therefore, normal distributions of abnormal returns of the portfolio are ensured.

Table 3: **Test for normal distribution of IPO market- adjusted returns in month 37 post IPO after deleting the outlier**

```
. sktest mabhri37

                    Skewness/Kurtosis tests for Normality
                                                      ------- joint ------
    Variable | Pr(Skewness)   Pr(Kurtosis)  adj chi2(2)     Prob>chi2
-------------+-------------------------------------------------------
    mabhri37 |       0.215          0.103          4.31        0.1157
```

Characteristics of the MABHR are statistically described in the below table using t-test. Although mean of returns in 34 months over 36 months after IPOs are negative, MABHR in only 22 months have negative mean with significant statistic value. Insignificant negative average returns are seen in the first three months and in second-half of year two after firms issuing shares. IPO sample consistently underperformed NASDAQ Composite Index in every month of the third year post IPO. This result suggests that long-term investment in IPOs in NASDAQ market is in general not a good strategy.

Table 4: Statistic Characteristics of the average abnormal returns of Sampled Portfolio for the 37 months after going public

Month	Mean	Std. Dev.	t-Statistic	Sig. Ha: mean<0	Sig. (2-tailed) Ha: mean=0
2*	0.0193	0.1631	1.2191	0.8872	0.2255
3	0.0002	0.2390	0.0081	0.5032	0.9936
4	-0.0051	0.2590	-0.2009	0.4206	0.8412
5	-0.0464	0.3042	-1.5709	0.0596	0.1192
6	-0.0661	0.3387	-2.0100	0.0235	0.0470
7	-0.0650	0.3800	-1.7597	0.0407	0.0814
8	-0.0685	0.3909	-1.8039	0.0371	0.0741
9	-0.0663	0.4189	-1.6288	0.0532	0.1064
10	-0.0584	0.4455	-1.3505	0.0899	0.1798
11	-0.0525	0.4895	-1.1036	0.1361	0.2723
12	-0.0656	0.5189	-1.3018	0.0979	0.1958
13	-0.0740	0.5438	-1.4003	0.0822	0.1644
14	-0.0726	0.5457	-1.3695	0.0869	0.1738
15	-0.0853	0.5663	-1.5513	0.0619	0.1238
16	-0.0712	0.5727	-1.2803	0.1016	0.2032
17	-0.0533	0.5912	-0.9280	0.1778	0.3555
18	-0.0522	0.6171	-0.8716	0.1927	0.3854
19	-0.0417	0.6306	-0.6810	0.2487	0.4973
20	-0.0463	0.6438	-0.7404	0.2304	0.4607
21	-0.0724	0.6594	-1.1297	0.1306	0.2612
22	-0.0770	0.6513	-1.2173	0.1131	0.2262
23	-0.0667	0.6609	-1.0395	0.1505	0.3009
24	-0.0638	0.6603	-0.9942	0.1612	0.3224
25	-0.0808	0.6659	-1.2499	0.1071	0.2141
26	-0.1020	0.6631	-1.5839	0.0581	0.1162
27	-0.1110	0.6858	-1.6667	0.0493	0.0986
28	-0.1348	0.6988	-1.9864	0.0248	0.0496
29	-0.1491	0.6962	-2.2043	0.0148	0.0297
30	-0.1662	0.6994	-2.4465	0.0080	0.0161
31	-0.1681	0.7013	-2.4675	0.0076	0.0152
32	-0.1661	0.7118	-2.4024	0.0090	0.0180
33	-0.1708	0.7097	-2.4785	0.0074	0.0148
34	-0.1744	0.7218	-2.4880	0.0072	0.0144
35	-0.1952	0.7371	-2.7260	0.0038	0.0075
36	-0.2040	0.7279	-2.8856	0.0024	0.0047
37	-0.2257	0.7279	-3.0683	0.0014	0.0027

Notes: * The first month of seasoning was not included in the study to avoid the effect of initial under-pricing. Mean, standard deviations, t-statistic, and significant values are of the Market Adjusted Buy and Hold Returns of IPOs stock in comparison with NASDAQ Composite Index.

Ritter (1991) and other authors suggest that underperformance concentrate on the small size firms. The study selects IPO firms with total asset less than 50 million USD and apply the t-test again, comparing mean of the abnormal returns in month 37th of small IPO firms portfolio with zero.

Table 5: Comparison mean of IPO long-term abnormal returns In month 37th with zero

```
. sktest mabhri37

                    Skewness/Kurtosis tests for Normality
                                                      ------ joint ------
    Variable | Pr(Skewness)   Pr(Kurtosis)  adj chi2(2)     Prob>chi2
-------------+-------------------------------------------------------
    mabhri37 |       0.228         0.102          4.25        0.1192

. ttest mabhri37==0

One-sample t test

------------------------------------------------------------------------------
Variable |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
mabhri37 |      55   -.3558095     .101763    .7546949   -.5598321   -.1517869
------------------------------------------------------------------------------
Degrees of freedom: 54

                     Ho: mean(mabhri37) = 0

     Ha: mean < 0                 Ha: mean != 0                 Ha: mean > 0
       t =  -3.4965                 t =  -3.4965                 t =  -3.4965
   P < t =   0.0005             P > |t| =   0.0010             P > t =   0.9995
```

Mean and median of long-term returns of the small firm issuers are -35.58% and -35.329% respectively. P-value of one-tailed test the hypothesis mean of the returns less than 0 is 0.0005 very significant, (more significant than p-value in the case of the original portfolio of all-size firms = 0.0014). This proves that IPOs of small firms more seriously underperformance the market. The result is consistent with empirical experience of other previous authors in the financial literature.

5.2. Relations between IPO long-term performance and characteristics of firms and IPO stocks

5.2.1. Cross-Sectional Analysis

First, cross-sectional and time series patterns are analyzed to catch the overall view of IPOs categorized by explanatory factors before further applying statistic models. IPO firms are segmented by explaining factors such as firm size, firm age, and market adjusted initial returns.

5.2.1.1. Time of issuance

The sampled IPOs are allocated by time of issuance, aiming at exploring the relationship between volumes of IPOs in the time plots, IPOs' market adjusted returns and their performance in long run. In previous research, authors apply one year as the time scale for categorizing IPO sample. However, this study focuses in analyzing IPOs in only three years 2002-2005 and the starting point is not the beginning but the middle of the year. Therefore, the study shortens time scale to 6 months, aiming at investigating IPO hot issue market in more detail.

Table 6: Numbers of IPOs, initial and long term performance of IPO sample categorized by time of issuance from 6/2002 to 6/2005

		MAAR				MABHR			
Time	No	Mean	Std.Dev.	t-statistic	Sig. (1) Ha: Mean>0	Mean	Std.Dev.	t-statistic	Sig. (1) Ha: Mean<0
7/02-12/02	9	-0.0521	0.182	-0.857	0.7917	0.0589	0.67198	0.2631	0.6004
1/03-6/03	1	0.004	.	.	0	0.3391	.	.	0
7/03-12/03	14	0.1851	0.145	4.786	0.0002	-0.2119	0.73528	-1.0785	0.1502
1/04-6/04	29	0.101	0.155	3.500	0.0008	-0.3564	0.77121	-2.4884	0.0095
7/04-12/04	30	0.083	0.144	3.160	0.0018	-0.3041	0.8455	-1.9699	0.0292
1/05-6/05	23	0.1109	0.115	4.628	0.0001	-0.1031	0.67869	-0.7286	0.237
Total	**106**	**0.0953**	**0.1523**			**-0.2257**	**0.75741**		
Sig. Value ANOVA compare means between groups					**0.012**				**0.614**

Note: All MAARs and MABHRs in sub-periods are checked for normal distribution. P-value in skew tests are all over 0.1, rejecting hypothesis of non-normal distribution of adjusted returns.

At the first glance of viewing market adjusted initial returns in the above time scales, under-pricing phenomenon is quite clear as supported by Ritter (1991) and many other authors.

Ibbotson (1975) explain the phenomenon as the 'hot market issue' phenomenon and indicate that higher initial returns tend to follow high volume of IPOs. This study attempts to search for evidence to such 'hot issue market' theory phenomenon in NASDAQ stock market. As can be seen in table 6, there are only 10 IPOs during 7/02-6/03 in comparison with over 20 IPOs every six months during 7/2003-6/2005. As such, the period from 7/2002 to 6/2005 can be divided into two sub-periods (7/2002-6/2003; 7/2003 -6/2005), considered as 'cold' and 'hot' ones, in which investors are pessimistic and optimistic towards initial public offerings respectively. Furthermore, mean of IPOs' initial market adjusted returns in so-called 'hot' period (7/03-6/05) is statistically significant positive and at about over 10% while it takes negative value or insignificantly positive in other periods.

Over-optimistic theory suggests higher returns in the first day of trading be followed by IPOs' lower performance in long run. Ritter (1991) explains that IPOs firms are good at time-catching to take advantage of 'window of opportunities' of the stock market. They usually go public at the time investors are at most excitement about stock trading. Then, as investors' overoptimistic period elapses long term performance of stock IPO will suffer. In this case, it is true that stocks issued in hot time poorly underperform the market whist stocks going public during the cold time outperform NASDAQ Composite Index in three years post IPO. Means of MABHRs are 0.0589 and 0.3391 during 7/02-12/02 and 1/03-6/03 respectively. P-value in the ANOVA test comparing means of MABHRs among different time plots is 0.614 (much bigger than 0.1), proving different performance of IPOs issued in different market situation. However, means of IPOs' initial market adjusted returns in similar time plots are significantly the same at 5% significant level. Thus, steadily negative relationship between MABHR and MAAR is not certainly true and will be further investigated in the regression part.

5.2.1.2. Gross proceeds

Table 7: IPOs' initial returns and Long-term performance Categorized by Gross-proceeds

Gross Proceeds Million USD	No	MAAR			MABHR		
		Mean	Median	Std.Dev.	Mean	Median	Std.Dev.
5-9.99	1	0.003	0.003		-0.365	0.003	
10-14.99	3	-0.175	-0.020	0.295	-0.663	-0.629	0.095
15-24.99	4	0.016	-0.018	0.082	-0.724	-0.419	0.904
25-49.99	26	0.087	0.026	0.116	-0.092	-0.027	0.699
50-74.99	28	0.104	0.097	0.129	-0.032	0.149	0.651
75-99.99	19	0.131	0.061	0.177	-0.489	-0.538	0.808
Over 100	25	0.116	0.076	0.158	-0.245	-0.437	0.864

From the above statistic description there is no clear constant relationship between size of the issuing and IPO long-term performance. Both mean and median statistic results show that IPOs with gross proceeds from 25-75 million USD have best performance in the long run. They are likely to perform better the IPOs of smaller size (gross-proceeds from 5 to 25 million USD); however, they also outperform the larger firms (gross proceeds above 75 million USD).

There is negative linkage between IPO initial and long-term returns as suggested in investors' behaviour and over-expectation theories in groups of IPOs with gross-proceeds from 5-50 and over 100 million USD, but not for IPOs in groups with gross proceeds of 50-100 million USD. Better initial returns indicate poorer long-term performance. Investors' over-optimism can also be seen in IPOs with the gross-proceeds over 100 million USD when comparing their initial and long-term abnormal returns with those in the smaller gross-proceeds scales from 5-50 million USD. IPOs with over 100 million USD gross proceeds have higher initial market adjusted returns, but tend to perform worst in three years after IPO.

5.2.1.3. Industry

Table 8 groups IPO firms by industry based on their industry SIC codes. Earnings are measured as average earnings of firm in three years before IPOs. Age of firm is measured as the calendar year of IPO minus the year firm is incorporated. In table 8 are mean and median of average earnings, gross proceeds and firm age, allocated based on industry.

Table 8: IPO firms' average earnings, gross-proceeds and age and Long-term performance categorized by Industry

Industry	SIC code	No	Averearnings		Gross proceeds		Age	
			Mean	Med	Mean	Med	Mean	Med
Communication, electronic equipment	366,367	8	-5.9	-2.7	75.5	76.7	7.8	7.5
Computer and data processing services	737	8	2.1	-2.1	293.9	87.5	9.6	7.0
Drugs and engenetic engineering	283	16	-17.4	-15.3	50.4	44.4	7.0	6.5
Financial, Poperty, Insurancer	6**	16	3.8	2.7	90.5	73.1	14.0	11.5
Optical, medical instruments	381-84	10	-18.3	-6.8	64.8	61.2	9.9	7.5
Wholesaler, retailers	501-599	19	3.7	2.8	77.3	57.0	22.1	12.0
Various Business services	738-874	12	-19.3	-13.1	151.6	53.8	19.9	9.5
Transports and Distribution	441, 451, 492	6	9.8	8.3	143.7	123.3	9.7	10.0
Others		11	-3.7	0.7	75.7	75.2	17.4	7.0
Total		106	-5.42	-0.39	102.26	65.64	14	8

As reported in table 8, there is no huge difference between mean and median of firm age in each industry in this IPO sample, similar to the sample of US stocks in Ritter (1991). Financial Banking, Property, Insurance industry and Wholesale and Retail industry are the two groups with the highest average age, but not much higher than average age of other industries. Also, they have comparatively higher gross-proceeds to other industry and are the only two with positive average earnings in three years before IPOs. A striking point in the NASDAQ IPO portfolio is that almost industries have negative mean and median of earnings before IPOs.

This can be explained that many of such companies are in high growth business stage, which needs huge capitals for finance for new potential projects. Especially this is true to almost every issuing firm in pharmacy industry. As reported in their prospectuses, most of them spend great funds for research and development.

Table 9: IPOs' initial returns and Long-term performance

Categorized by Industry

Industry	SIC code	No	MAAR		MABHR		Stdev MABHR	
			Mean	Med	Mean	Med	Mean	Med
Communication, electronic equipment	366,367	8	0.1	0.0	-0.1	0.2	4.6	3.5
Computer and data processing services	737	8	0.2	0.3	-0.3	-0.3	19.9	4.9
Drugs and energetic engineering	283	16	0.0	0.0	-0.4	-0.6	3.8	3.2
Financial, Property, Insurance	6**	16	0.1	0.1	0.0	0.2	4.7	4.0
Optical, medical instruments	381-84	10	0.0	0.0	-0.2	-0.2	4.8	4.6
Wholesaler, retailers	501-599	19	0.1	0.1	-0.4	-0.2	7.7	6.8
Various Business services	738-874	12	0.2	0.1	-0.3	-0.4	5.4	4.5
Transports and Distribution	441, 451, 492	6	0.1	0.1	0.2	0.2	9.6	6.1
Others		11	0.1	0.1	4.0	2.6	-0.4	-0.4

In table 9, means and median of IPO initial, long-term abnormal returns, and stocks volatility are categorized by industry. As reported in the table, financial, property, insurance industry has better long term performance than some of other industries. This can be explained by previous author that this special industry is less risky than others. Furthermore, comparative higher earnings of the industry in the past imply a continuing comparative better performance of firms in financial, property, insurance than those in other industries in the long run. However, financial, property, insurance still underperform the group Transports and Distributions and group Others although these groups have negative earnings before IPOs. In addition, the group of Wholesalers and Retailers seriously underperform the market and other industry despite its higher and positive earnings before IPO. Simple statistics on the table partly state two points: (1) Earnings of firms before IPO and long-term performance of IPO stocks are not always positively related. (2) Financial, property and insurance industry

does not surely have specialty over other industries. Regression will further investigate and double-check these findings.

5.3. Regression results

Simple statistic descriptions in the previous section partly present relationships between explaining factors (i.e. pre-IPO firm characteristics and IPOs themselves during a 3-year period post IPO) and performance of IPO stocks in the long run. In this section, regression analysis will be applied to examine such relations using mathematical statistic models. The goal in the regression approach is to predict long-tem performance of IPOs (dependent variable) based upon already known or predictable independent variables such as IPOs' initial market adjusted returns, IPO volume, volatility of IPO stocks, firm size, age, earnings, underwriter reputation, multi-nationality of firm, special characteristics of firm in financial service sector and ownership retention after IPOs. Characteristics of the variables in the regression are described in table 10.

Table 10: Descriptive statistics of independent variables

Variable	Obs	Mean	Std Dev	Min	Max
MAARi	106	0.10	0.15	-0.52	0.51
VOL	106	0.94	0.29	0.00	1.00
GROSSPROCEEDs	106	102.26	180.03	8.50	16666.85
ASSFLOAT	106	143.72	242.97	1.31	169.33
MCAFLOAT	106	595.96	2647.18	16.75	27211.50
AGE	106	13.07	16.44	1.00	104.00
AVRINC	106	-5.42	21.26	-123.79	70.76
AVRINCAVERASSET	106	-0.18	0.46	-2.66	0.76
UNDERWRITERANK	106	0.44	0.50	0.00	1.00
MULTINATIONALITY	106	0.23	0.42	0.00	1.00
SPECINDUSTRY	106	0.14	0.35	0.00	1.00
EQUISSUE	106	0.35	0.19	0.07	1.00
STDEV	106	6.53	12.40	0.66	125.12
MABHRi37	106	-0.23	0.76	-2.05	1.22

Stata statistic software is used in this study to perform stated regression models. Ordinary Least Squares (OLS) method is applied. Although OLS is a simple model, it is proved in previous researches in the financial literature to be very effective to examine relationships of studied factors. Nevertheless, OLS only

provides best results if its assumptions are satisfied. All of these assumptions are checked during the regression procedure to ascertain accuracy of the findings. See assumptions of OLS in appendix 2.

Table 11: Regression results

	Model 1	Model 2*	Model 3*	Model 4*	Model 5	Model 6	Model 7	Model 8
MAAR	-0.2993	-0.5358	-0.5696	-0.6308	-0.3251	-0.1082	-0.1299	-0.1136
	(0.54)	(0.315)	(0.283)	(0.238)	(0.573)	(0.844)	(0.815)	(0.838)
MAARVOL		1.7179	1.5678	1.6002	1.5479	1.4855	1.4249	1.5217
		(0.267)	(0.308)	(0.297)	(0.292)	(0.298)	(0.321)	(0.292)
ASSFLOAT			0.0004	0.000355	0.0004156	0.000475	0.00036	0.000427
			(0.256)	(0.255)	(0.17)	(0.107)	(0.292)	(0.226)
MCAFLOAT			5E-05	4.52E-05				
			(0.1)	(0.133)				
LnMCAFLOAT					-0.1694	-0.1913	-0.1774	-0.2202
					(0.112)	(0.044)	(0.068)	(0.05)
Ln(1+AGE)				0.1693	0.1827	0.1553	0.1537	0.1697
				(0.087)	(0.054)	(0.088)	(0.092)	(0.071)
AVERINC				0.0018	-0.0018			
				(0.632)	(0.627)			
UNDEWRITERRANK				-0.0186	0.0800			
				(0.903)	(0.617)			
STDEV					0.0262	0.0229	0.0230	0.0238
					(0.001)	(0.001)	(0.001)	(0.001)
MULTINATIONALITY						0.3865	0.3889	0.3978
						(0.028)	(0.028)	(0.025)
SPECINDUSTRY							0.1583	0.1660
							(0.487)	(0.468)
EQUISSUE								-0.3429
								(0.438)
Constant	0.026	-0.167	-0.243	-0.6203	0.0310	0.1665	0.0895	0.3857
No of Observations	106	106	106	106	106	106	106	106
Adjusted R-Squared	-0.006	-0.0036	0.0597	0.0287	0.1119	0.1591	0.1546	0.2239
p-sktest error	0.122	0.1421	0.1151	0.1666	0.1279	0.2661	0.2289	0.2953
P-Breusch-Pagan test	0.7361	0.3411	0.6902	0.1247	0.7283	0.4166	0.3597	0.3511

** Top figure is coefficient of the independent variable*

*** the figure in the bracket is the p-value*

As stated in the cross-sectional analysis, negative relationship between IPO initial market adjusted returns and returns in three year holding period is still ubiquitous. In all regression models coefficient of MAAR and MABHR is consistently negative, however, the value is not significant. Thus, there is not enough evidence to make option of stocks, which have better performance in three years based on their performance in very first days of trading.

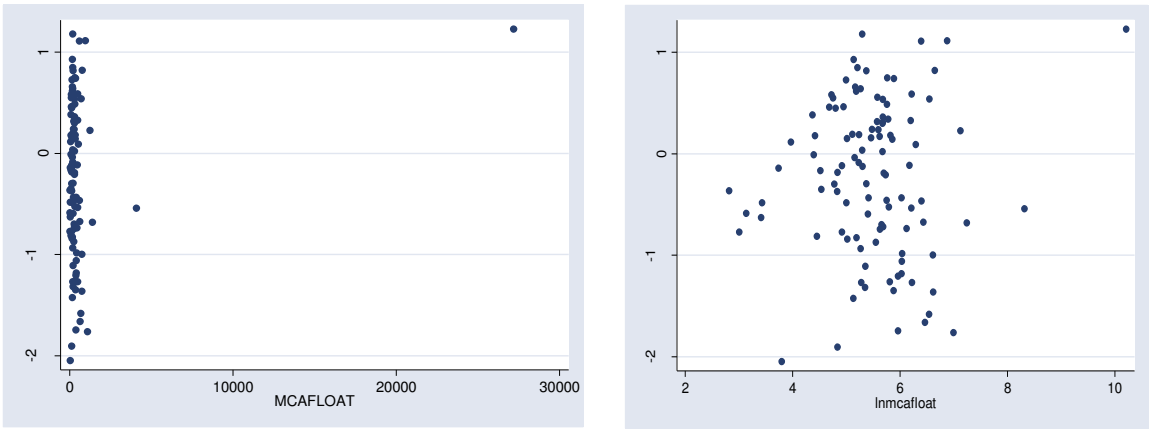
Positive coefficient of dummy variable VOL and MABHR in model 2a shows that firms going public in cold period perform better than the rest. In other words, IPOs in 'hot issue market' tends to underperform the market more poorly, which is consistent to previous studies. However, the result is also insignificant. Non-distribution of the error terms (p-value of the error skewness test is 0.095<0.1) may cause problem to the regression. To be prudent, the study performs another regression using VOL as a slope dummy variable in model 2*. The intercept (-0.5358) is the same for both IPOs publishing in hot and cold market, but the slope of the line (1.7179) differs across the two groups. That means if IPO initial market adjusted return increases one unit, IPO stock issued in cold period will outperform stock issued in hot period 1.7179 unit. Again, the big p-value does not confirm conclusion of a negative relation between MABHR and dummy variable Vol. The reason might be that the 'hot issue' during 6/2002-6/2005 is not clear enough. There is not strong over-optimism and over-expectation among investors at a certain time compared to the rest.

On regression there is a strong correlation between MCAFLOAT and GROSSPROCEEDs (0.9161), which makes it difficult to differentiate the contribution of individual correlated explanatory factor to dependent factor MABHR. The multicollinearity phenomenon cause different sign for coefficient of variable GROSSPROCEEDs and insignificance of other variables. To avoid multicollinearity, GROSSPROCEEDs has been deleted. MCAFLOAT is the most significant proxy among proxies for firm size to explain underperformance of IPOs, but still slightly higher than satisfactory p-valuable at level of 90% confidence. Nonlinear relationship between MCAFLOAT and MABHR might be the main cause.

Furthermore, in model 5 when proxy for risk – IPO stock's volatility is included as an explanatory variable, MCAFLOAT and STDEV strongly correlates each other, causing multicollinearity. To form better models, the study applies natural log function to transform MCAFLOAT into LnMCAFLOAT and uses LnMCAFLOAT as a replacement variable for MCAFLOAT in the following models.

Scattering plot describes relationship of lnMCAFLOAT with IPO long-term performance after its transformation from MCAFLOAT.

Figure 7: Scatter relationship firms' market capitalization and IPO long-term performance before and after transformation of variable MCAFLOAT



As a result, LnMCAFLOAT has fairly significant relation with MABHR. The findings reject null hypothesis 3. Bigger firms going public during 6/2002-6/2005 in NASDAQ stock exchange have poorer performance than the smaller ones. For example, in model 8, the best model with adjusted-R–squared ratio of 22.39% when firm market capitalization increase 1% the performance of IPO in three years will decrease by 0.0022 or 0.22% ceteris paribus. The regression result support for Gounopoulos et al (2007) and is object to past literature of positive relation between IPO firm size and IPO long-term performance in Ritter (1991), Cater et al (1998), Levis (1993). As explanation by Ritter (1991), Cater et al (1998), Levis (1993) larger firms usually have better quality, therefore, tend to have better performance. Titman and Wessels (1988) and Schultz (1993) also support that

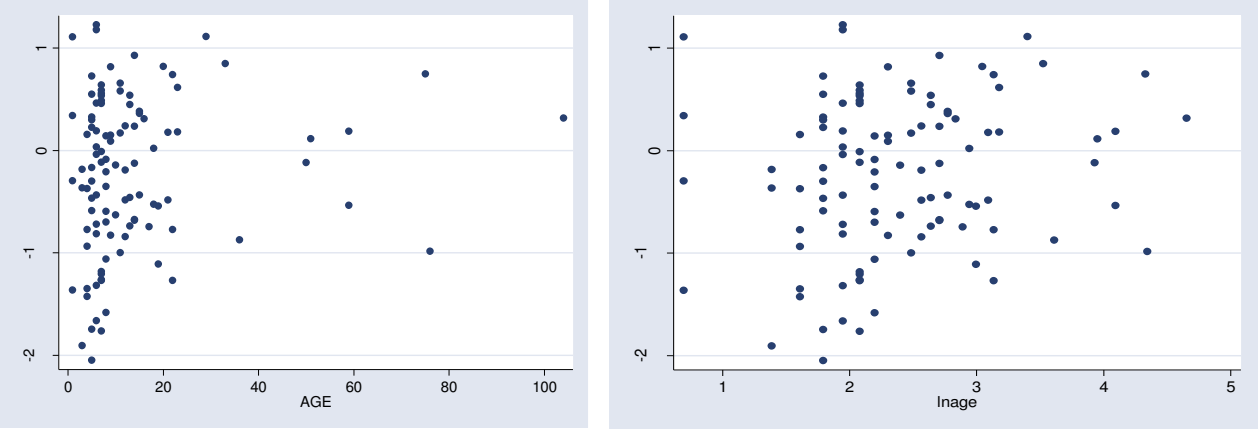
larger firms include less risk because they likely to be more diversified and have better access to funds. However, these explanations are not applied in the NASDAQ market. The converse results in this study show the efficiency of smaller firms. In a growth period of the market in general in a market with a lot of high growth stocks, investors may be less risk averse and willing to invest in some smaller firms with more volatility but high potential in the future. Stock volatility and IPO long-term performance will be examined further in the below part.

Negative relation of firm market capitalization and IPO long term performance can also be explained by the concept of market capitalization. Market capitalization and firm total asset, both are proxies for firm size; however, they are still different. As the definition from Investopedia 'Market capitalization is calculated by multiplying a company's shares outstanding by the current market price of one share. The investment community uses this figure to determining a company's size, as opposed to sales or total asset figures.' Simply, total asset is what is on the firm financial statements; market capitalization is how investors evaluate present value of firm. Market capitalization represents for firm market value while total asset is for book value. Elliott and Elliot (2004) explain the difference of book value and market value by the subjectivity of accounting statements and their interpretations. Another explanation for IPO underperformance is that investors be over-optimistic towards bigger size firms. Market capitalization can be understood as the combination of stock price and firm size. Although initial stock returns, as proxy for investors' over-optimism towards IPO at the time of offering, cannot fully explain the underperformance of IPO stock, market capitalization supports for over-optimism theory, indicating that the whole IPO firms have been over-evaluated in the first days of trading. When investors' over-optimism passed, firm stock will underperform the market. Information asymmetry may also provide explanations. Due to firms' management earnings before IPOs, the firm value is highly over-estimated. When investors recognized the firm true value, its stock price will suffer.

Model 4 includes explanatory factors, which are proxies for IPO firms' quality and risks of IPO offerings as suggested in Khurshed (1999). The adjusted-R-

squared ratio is very low, only about 3% of the IPO long-term performance is explained by the independent variables. As stated before, this study does not limit to IPO's firm characteristics and IPO performance in the long run. Instead, the research scale is widened to other useful explanatory elements for investors' prediction of IPO's performance and their investment decision. Inclusion of stock volatility increases the value of adjusted-R-Squared ratio considerably to 11.19% in model 5. In addition, explanatory firm age is transformed into ln(1+age) in regression analysis, following Ritter(1991). As can be seen in the below scattering plot Ln(1+age) have stronger linear relationship to MABHR.

Figure 8: Scatter relationship firms' market capitalization and IPO long-term performance before and after transformation of variable AGE



Variation of long-term performance of stocks after IPO is explained by firm age. In regression models Ln(1+age) significant at confidence level of 90%, p-values are all below critical value of 0.1. Coefficients of Ln(1+age) and MABHR are all positive, indicating a positive influence of firm age to IPO long-term performance. For example, in model 8, a 1% increase in (1+age) will increase IPO abnormal return by 0.1697% ceteris paribus.

Earnings is considered as persistent element, which means that firms have good earnings before IPO will continue perform well after IPO. Therefore, IPO stock of firms with high net earnings prior to IPO should have better performance in three

years post IPO. On the other side, others support the argument that firms usually choose to go public at top of their performance. Converse relation between firm's net earnings before floatation and long-term IPO stock performance is found in researches of Khurshed et al (1999) and Mikkelson and Shah (1997). This study finds no supporting evidence to both above theories. Coefficient of firms' profitability before flotation and stock performance is inconsistent, taking negative value in model 4 but positive value in model 5. Earnings prior to floatation of firm going public in NASDAQ during 6/2002-6/2007 IPO have no significant connection to IPO performance. Therefore, investors cannot get free lunch profit from three-year investment in IPO stocks on NASDAQ stock exchange by buying firms with higher previous performance.

Cater and Manaster (1990) argues that firm risk and underwriter reputation is conversely connected. Wolfe, Cooperman and Ferris (1994) also find that prestigious underwriters on purpose of reducing uncertainty of an initial offerings and protecting their reputation usually avoid small and risky IPOs. However, this study finds no connection between underwriter reputation and performance of IPO in long run. Coefficient of dummy variable UNDERWRITERRANK AND MABHR is negative in model 4 but little higher than zero in model 5. Additionally, relationship between the two is not significant in both two models. The result is inconsistent with an inverse relation between IPO performance in long run and underwriter prestige shown in Cater and Manaster (1990) and Wolfe, Cooperman and Ferris (1994). The null hypothesis of no relation between underwriter rank and IPO long-term performance is not rejected. Findings indicate that such previous theory is not true in NASDAQ stock market during research period of time.

There is still not much literature about IPO long term performance and the IPO stock characteristic such as volatility. IPO stock performance and firm risks are expected to have a converse relation because riskier firms are more likely to have bad quality and poorer performance in the future. In contrast, different from the conception of firm risks, risk characteristic of IPO stock itself – measured by stock volatility is expected have positive relation with stock performance. Stock volatility is the most significant variable in the research with p-value of 0.001 or lower in all

model regression. Regression results confirm that IPOs stocks in NASDAQ with higher volatility will outperform the rest. US stock market in general and NASDAQ stock exchange in particular are constantly increasing in the period 6/2002-6/2008. This finding proves that in the growth period of the market investors will gain more profit in NASDAQ stock exchange when they invest in highly volatile companies, which are supposed to be smaller ones with high growth rate. Also, it proves that riskier investors in IPO will gain more earnings in NASDAQ stock exchange during 6/2002-6/2005.

Khurshed (1999) find a strong connection between firm multi-nationality and its IPO long term performance regardless of firm size. The more multi-national a firm is, the more it is attractive to investors. Findings in this study support to Khurshed's argument and signaling theory that firm multi-nationality signals firm quality and reputation. The variable MULTINATIONALITY is fairly significant to IPO performance in long run with positive coefficient. According to regression result in model 8, statically multi-national IPO firm outperform their domestics partners 2,5% in three years post IPO.

Ritter (1991) previously indicates that special characteristics of firm in banking, finance, insurance sector lead to the different performance of their IPOs in comparison with IPOs in other sectors. Ritter (1991) inserts the best IPO long-term performance of financial institutions. However, no superior performance of firms in this sector is concluded in NASDAQ market during 2002-2005. Coefficient of variable SPECINDUSTRY and MABHR is high, suggesting that firms in such special industry may outperform the others about 15%, ceteris peribus. However, high p-value shows insufficiency of the conclusion. Not enough significant proportion of firms in banking and business service sector outperform others in three years post IPO. Therefore, investing in IPOs firms in this sector in NASDAQ market does not ensure comparative good results.

Gale and Stiglitz (1989), Grinblatt and Hwang (1989), Courteau (1995) regard ownership retention after IPO as indicator of firm risk. As such, IPO firms with high ownership retention, in other words, more commitment of insiders are

usually better quality issuer. EQUISSUE has high p-value in regression model 8, showing its insignificant relationship with IPO abnormal returns.

Table 12: Variable deletion Tests

	***	Test 1	Test 2	Test 3	Test 4	Test 5
MAAR	-0.0849					
	(0.88)					
MAARVOL	1.4942					
	(0.305)					
ASSFLOAT	0.00039	0.00039	0.00034	0.00036	0.00037	0.0005
	(0.272)	(0.265)	(0.318)	(0.276)	(0.265)	(0.084)
LnMCAFLOAT	-0.2447	-0.2244	-0.1953	-0.1772	-0.1675	-0.1797
	(0.043)	(0.035)	(0.038)	(0.04)	(0.047)	(0.03)
Ln(1+AGE)	0.1789	0.1772	0.1655	0.1622	0.1533	0.1555
	(0.062)	(0.062)	(0.074)	(0.078)	(0.09)	(0.085)
AVERINC	-0.0020	-0.0021	-0.0022	-0.0022		
	(0.596)	(0.577)	(0.543)	(0.54)		
UNDWRTRANK	0.07395	0.07296	0.07801			
	0.642	0.643	0.618			
STDEV	0.0260	0.0257	0.0253	0.0247	0.0228	0.0226
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
MULTINATIONALITY	0.3909	0.3864	0.3802	0.3858	0.3889	0.3842
	(0.029)	(0.027)	(0.028)	(0.025)	(0.024)	(0.025)
SPECINDUSTRY	0.2026	0.2207	0.2164	0.2031	0.1742	
	(0.392)	(0.347)	(0.355)	(0.38)	(0.44)	
EQUISSUE	-0.3139	-0.2670				
	(0.483)	(0.547)				
Constant	0.429	0.291	0.076	0.0198	0.0149	0.085
No of Observations	106	106	106	106	106	106
Adjusted R-Squared	0.1377	0.1457	0.1513	0.1578	0.1631	0.2061
p-sktest error	0.3122	0.1889	0.1476	0.1264	0.1413	0.1760
P-Breusch-Pagan test	0.3033	0.255	0.2642	0.2723	0.3080	0.3709
p-value deletion test		0.57	0.5466	0.6184	0.54	0.4402

Table 12 describes regression results of models with independent variables grouped based on explanatory theories as suggested in the literature. Noticing that significance of independent variables will change accordingly to different set of explaining variables in regression models, variable deletion tests are conducted to double-check the compatibility of existing models. First, run a regression with a full

set of discussed explaining variables. Then, run deletion test, using command 'test' in Stata's command window with insignificants variables. The variable, which has the highest p-value in deletion test, is taken out of the next model.

Various combinations of explaining variables in variable deletion tests confirm strong positive relation of stock volatility, and fairly significance influences of firm size, firm age, as well as multi-nationality to IPO abnormal returns post issuing events. Surprisingly, factor ASSFLOAT becomes fairly significant in the last model, affirming that firms' total asset has certain role in explaining IPO performance in the long run. R-square ratios show that model 8 is the best model, which can explain IPO performance the most (over 22%), followed by model test 5 among variable deletion tests (20.61%).

CHAPTER 6: SUMMARY AND CONCLUSIONS

There is huge financial literature of IPO under-pricing and 'hot issue market'; however, fewer researches are done with IPO long-term performance. It is suspicious that every stock exchange has its own characteristics, which differentiate itself from other stock exchanges even in the same countries. Furthermore, stocks in different market conditions may perform in different ways. The study has enriched the financial literature of US stock IPOs, with further focus on NASDAQ stock exchange, one of the largest stock exchanges in the US during its continuous growth period. Besides that, research findings withdrawn from empirical experience provide investors useful advices on investment in a similar market.

The research findings indicated IPO long-term underperformance phenomenon in US market, which is consistent with previous researcher such as Ritter (1991). In a boarder view, the study again provides evidence of IPO long-term underperformance in a developed market. In three years after IPOs (the first month excluded), the research sample underperforms NASDAQ stock exchange 22.57%, which is very near results of Ritter (1991). Another similar conclusion is that the long-term performance of IPO is more seriously to small-size firms, especially firms with total asset less than 50 million USD.

The second aim of this paper is to investigate IPO underperformance in NASDAQ market in three years with firm and stock characteristics as suggested by explanatory theories. First, in contrast to findings of Khurshed (1999), this study find no consistent negative relationship between IPO long-term returns and initial returns although there is still appearance of under-pricing phenomenon (positive market adjusted returns in the first trading day of IPO).

Second, despite no significant result in the regression test, statistic descriptions pointed out that IPOs issued in hotter period with higher volume of IPOs tend to underperform the market benchmark more than ones going public in the 'cooler' period. This follows the 'hot issue market' hypothesis proposed by

Ljungqvist, Nanda, and Singh (2005). However, NASDAQ market grows gradually during 6/2002-6/2005. There is not distinguishably hot period with investors' striking high expectation in comparison with rest of time during studied period. Thus, 'hot issue market' hypothesis explain not much the IPO underperformance in this case.

Third, a negative relation between market capitalization of issuing firms at the time of going public and IPO long-term performance on NASDAQ exchange is investigated. The result contradict to previous positive relationship of IPO long-term performance and firm size using firm gross proceeds as proxies by Ritter (1991) and Khurshed (1999). The regression result in this study does not support signaling theory that large size signals firm quality and higher IPO long-term performance. In a growth period of the market investors trading on NASDAQ, a market with a lot of high growth stocks investors are less risk averse and willing to invest in smaller firms with more volatility but high potential in the future. Another conclusion following over-optimism theory is that bigger firms tend to be over-evaluated after the first trading days on NASDAQ market. Therefore, investors should be careful when choosing IPOs stock of firm with high market capitalization after their first trading day for long term investment.

Fourth, this paper finds that age is the best proxy firm risk and supports for signaling theory with significant influence to IPO long-term performance. Stocks of firms with higher age tend to perform better in the long run. On the other hand, there is no significant relationship between IPO long-term performance and other proxies for firm quality and risks such as previous earnings of firm and underwriter rank. Conclusion of Khurshed (1999) in UK market is not completely applied to NASDAQ market during 2002-2005.

Another finding is the strong positive relation between stock volatility and its performance. This proves that during the growth period of the market riskier IPO investors will gain more profits in long term than risk adverse ones by investing in firms with high stock volatility in NASDAQ exchange.

Sixth, multi-nationality has a considerably important role in predicting IPO long-term performance. As suggested by Khurshed et al (1999) multinational companies, which have subsidiaries overseas are usually well-qualified, hence their stocks are less underperform the market as the other IPOs in the long run.

Seventh, finance, banking, and insurance industry is found to outperform many of other industries. There are many chances that after three years of IPO stock of firms in this industry with its special quality and less risk will continue outperform the market, which is suggested by Ritter (1991). However, as suggest in the description part of the research during a certain period of time, some industries are more favourable and more highly profitable than others. This is consistent with Brown (1999). Therefore, investment in finance, banking, property and insurance industry is not always the best choice.

Lastly, the negative coefficient of the proportion of equity sold at the point of floatation and IPO stock long-term performance is consistent with Khurshed (1999). This suggests that the more commitment of insiders signal high quality of companies and good performance of stock in the future. However, the insignificance of p-value shows that this is not always true. A reason is that many firms in NASDAQ going public in this period because of their needs of huge capitals for development, especially companies in pharmacy industry. High portion of equity sold can be sold to finance a potential project. Earnings of the successful project in the future will enhance stock price. Therefore, it is not highly likely that stock of firm with high ownership retention will have better performance in NASDAQ exchange. Investors should investigate more about the companies' potential future project instead of making decision solely based on commitment of insiders.

In conclusion, some advices for investors can be withdrawn from this empirical research. Due to the IPO long-term performance phenomenon, investors should not buy IPO stocks within several first trading days and keep them for three years in NASDAQ in particular and other developed stock markets in general. Severer underperformance of smaller IPO stocks suggests that if an investor insists in investing in IPOs in long-term, between two IPO stocks he should not invest the small size one, other elements stay the same.

During the continuous growth of NASDAQ stock market, there are not distinguishably 'hot' and 'cold' periods. Hence, investment in IPOs at the time with little higher IPO volumes cannot ensure free lunch profits for long-term investors. However, due to existence of investors' over-optimism towards IPOs, bigger firms tend to be over evaluated after the first trading days. Therefore, an advice is investors should be careful when choosing IPOs stock of firm with strikingly high market capitalization after their first trading day for long term investment. On NASDAQ market, during 2002-2005, firm age and multi-nationality are the best proxies for risk and quality of firm. According to signaling theory, IPO long-term investors should choose established firms with higher age and more level of multi-nationality. On the other hand, investors should not solely base decision of long-term IPO investment on firm earnings before floatation, underwriter ranking or ownership retention. Also, in a continuous growth period of stock market, long-term investment in IPO stocks with higher volatility will be more profitable. IPOs in finance, banking, and insurance generally outperform IPOs in other industries in three-year period. However, investment in this industry is not the best option.

CHAPTER 7: LIMITATIONS AND FUTURE RESEARCH

The study has provided a result of IPO underperformance of US stock consistent to previous findings and relatively reasonable results of relationship between IPO performance and characteristics of issuing firms and IPO stocks in NASDAQ exchange during a continuing growth period. However, there are still some inherent limitations that should be acknowledged. Based on such limitation, further studies can be developed in the future to generate fruitful results.

The research data is collected by hand from the various sources such as financial websites and prospectus of the companies. Some IPOs of small firms are not included in the website of MSN. Some others are included in the website but without sufficient information and data from their prospectus. The lack of data or inefficient data from such secondary sources may affect the research findings. This research limitation exists more or less in any studies and is mentioned in Ritter (1991) as 'survivor bias'. With full and sufficient source of data, future research can improve its credibility.

In this study of long-term IPO abnormal returns, NASDAQ Composite Index is chosen as the benchmark. During the holding time period of the study, some bad-quality firms may go bankrupt or be delisted from the index bench mark. On the other hand, the stock exchange may include new listed firm, which are not in the research sample. This causes an inherent limitation to the research results, which is called 'new listing biases in Barber (1997). Another statistic limitation is the 'skewness bias' because IPO abnormal returns are not always totally normally distributed as the assumption of the statistic tests applied.

Researchers have different method of measurement to calculate abnormal returns of IPO. Ritter (1991), Levis (1993), Brown (1999), Khurshed (1999) used both CAR and BHRs. Khurshed et al (2004) use Fama and French three factor model. Also, some authors compare such raw returns with various bench-mark such as size and industry matching firms (Ritter 1991), size and book-to-market ratio matching firm, (Brav, Geczy and Gompers 2000), sample portfolio returns (i.e. Ritter 1991, Wolfgang Bessler and Stefan Thies 1994), equally weighted index, value weighted index.

Different results of IPO long-term underperformance are found when various measurement methods and bench-marks are applied. Accuracy of each measurement metrics and benchmark is still controversial issues. Thus, although BHRs are more popularly applied and considered as more suitable in this research, it is worthy to try other measurement methods and bench-marks to make comparison in future research.

The level of IPO underperformance is fairly near that of all IPOs in the US market. In spite of Khurshed (1999)'s research in the UK market, there is still no research of relationship of IPO underperformance in long run with a similar set of characteristics of firms and IPO stocks for the US market. This study focuses on long-term performance IPOs in NASDAQ stock exchange. It is suspicious that even stock exchanges in the same countries have some different characteristics; future research can be implemented to IPOs in NYSE stock exchange and in US market as a whole to compare the results and more carefully examine the difference among the markets.

As suggested by Ibbotson (1975) IPO performance follows a U shape. Ibbotson (1975) and Rao (1989) did not find a significant underperformance of IPO when studied holding period is extending over three years. Servaes and Rajan (1997) and Loughran (1993) found a severely underperformance of IPO in longer periods of time, five years and six years respectively. Therefore, different holding periods can be added in future research, and further time series research can be conducted to investigate more the performance behaviour of IPOs and the predictability of firms and stocks' characteristics to IPO stock performance.

Lastly, this study focuses on a continuous growth period of the stock market. In different market situation IPOs may behave differently. Research time scale are various among the literature of IPO long-term performance. Another suggestion for further study is to conduct research on IPO long-term performance in downturn period of the stock market or expand the time frame to investigate IPO long-term performance in fluctuation period of stock market. Such findings may contribute to the literature views of long-term underperformance of IPO in various angles.

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APPENDIX 1: INITIAL LISTING REQUIREMENTS IN NASDAQ STOCK EXCHANGE

1/ Global Select Market

Financial and qualitative requirements

Requirements	Standard 1 Listing Rules 5315(e) and 5315(f)(3)(A)	Standard 2 Listing Rules 5315(e) and 5315(f)(3)(B)	Standard 3 Listing Rules 5315(e) and 5315(f)(3)(C)
Pre-tax earnings[1] (income from continuing operations before income taxes)	Aggregate in prior three fiscal years ≥ $11 million and Each of the two most recent fiscal years ≥ $2.2 million and Each of the prior three fiscal years ≥ $0	N/A	N/A
Cash flows	N/A	Aggregate in prior three fiscal years ≥ $27.5 million and Each of the prior three fiscal years ≥ $0	N/A
Market capitalization	N/A	Average ≥ $550 million over prior 12 months	Average ≥ $850 million over prior 12 months
Revenue	N/A	Previous fiscal year ≥ $110 million	Previous fiscal year ≥ $90 million
Bid price	$4	$4	$4
Market makers	3 or 4	3 or 4	3 or 4
Corporate governance	Yes	Yes	Yes

Liquidity requirements

New Company Listings				
Requirements	**Initial Public Offerings and Spin-Off Companies**	**Seasoned Companies: Currently Trading Common Stock or Equivalents**	**Affiliated Companies[1]**	**Listing Rules**
Round lot shareholders **or** Total shareholders **or** Total shareholders and Average monthly trading volume over past twelve months[2]	450 **or** 2,200	450 **or** 2,200 **or** 550 and 1.1 million	450 **or** 2,200 **or** 550 and 1.1 million	5315(f)(1)
Publicly held shares[3]	1,250,000	1,250,000	1,250,000	5315(e)(2)
Market value of publicly held shares **or** Market value of publicly held shares and Stockholders' equity	$70 million	$110 million **or** $100 million and $110 million	$70 million	5315(f)(2)

2/ Global Market

Requirements	Income Standard Listing Rules 5405(a) and 5405(b)(1)	Equity Standard Listing Rules 5405(a) and 5405(b)(2)	Market Value Standard Listing Rules 5405(a) and 5405(b)(3)[2]	Total Assets/Total Revenue Standard Listing Rules 5405(a) and 5405(b)(4)
Income from continuing operations before income taxes (in latest fiscal year **or** in two of last three fiscal years)	$1 million	N/A	N/A	N/A
Stockholders' equity	$15 million	$30 million	N/A	N/A
Market value of listed securities	N/A	N/A	$75 million	N/A
Total assets and Total revenue (in latest fiscal year **or** in two of last three fiscal years)	N/A	N/A	N/A	$75 million and $75 million
Publicly held shares	1.1 million	1.1 million	1.1 million	1.1 million
Market value of publicly held shares	$8 million	$18 million	$20 million	$20 million
Bid price	$4	$4	$4[2]	$4
Shareholders (round lot holders)	400	400	400	400
Market makers	3	3	4	4
Operating history	N/A	2 years	N/A	N/A
Corporate governance	Yes	Yes	Yes	Yes

3/Capital Market

Requirements	Equity Standard Listing Rules 5505(a) and 5505(b)(1)	Market Value of Listed Securities Standard Listing Rules 5505(a) and 5505(b)(2)[2]	Net Income Standard Listing Rules 5505(a) and 5505(b)(3)
Stockholders' equity	$5 million	$4 million	$4 million
Market value of publicly held shares	$15 million	$15 million	$5 million
Operating history	2 years	N/A	N/A
Market value of listed securities	N/A	$50 million	N/A
Net income from continuing operations (in the latest fiscal year or in two of the last three fiscal years)	N/A	N/A	$750,000
Bid price	$4	$4	$4
Publicly held shares	1 million	1 million	1 million
Shareholders (round lot holders)	300	300	300
Market makers	3	3	3
Corporate governance	Yes	Yes	Yes

Source: http://www.nasdaq.com/about/nasdaq_listing_req_fees.pdf

APPENDIX 2: OLS ASSUMPTIONS (GAUSSIAN ASSUMPTIONS)

1. The model is linear in parameters
2. The error terms are normally distributed
2. Values of X (independent variable) are precise
3. Given the X value, the expected value of the error term is zero
4. The error term and the X values has zero covariance
5. The error term has constant variance, given the X values (No heteroscedaticity)
6. There are no auto-correlations among the error terms (No serial correlation)
7. The number of observations is more than the number of parameters
8. Independent variables are not strongly collinear (No multicollinearity)
9. Values of independent variables are not the same across observations

APPENDIX 2b: TESTS OF OLS ASSUMPTIONS

Besides other assumptions that are observables, the assumptions of normality of error terms, no multicollinearity, no heteroscedasticity have been tested during the regression process.

1. Normality of Error terms

- Obtain the histogram of error terms

- Use skewness test such as skewness/Kurtosis test for error terms with null hypothesis of normal distribution. Insignificance results of the test indicate normality of error terms.

2. Multicollinearity

- Obtain VIF/Tolerance coefficient value (Tolerance= 1/ VIF). It is considered no multicollinearity if Tolerance is higher than 1 or VIF is smaller than 10.

- Use correlation matrix. Two variables are considered strongly correlated if the correlation coefficient is more than 0.75. In this case, one of the correlated variable need to be dropped from the model.

Multicollinearity causes:

- Make variables statistically insignificant even if they are important
- Create artificially high R square
- One of coefficients with wrong sign

3. Heterosdasticity

- Plot diagram of residuals and fitted values to check heterosdasticity

- Apply Breusch-Pagan test (estat hottest) with null hypothesis of no heterosdasticity. P- value should be higher than 0.1 at level of confidence 90% to confirm assumption of homoscedasticity

Natural logarithms transformation is a convenient way to correct heterosdasticity.

(Source: Lecture note, Further Quantitative Method, University of Nottingham)

APPENDIX 3: CORRELATION MATRIX OF INDEPENDENT VARIABLES

```
. correl maari0 vol grossproceeds assfloat mcafloat underwriterrank multinationa
> lity specindustry equissue stdev
(obs=106)
```

	maari0	vol	grossp~s	assfloat	mcafloat	underw~k	multin~y
maari0	1.0000						
vol	-0.3019	1.0000					
grossproce~s	0.1062	0.0013	1.0000				
assfloat	-0.0365	0.2754	0.2848	1.0000			
mcafloat	0.0924	-0.0464	0.9161	0.1439	1.0000		
underwrite~k	0.0911	-0.0282	0.2299	0.1848	0.1582	1.0000	
multinatio~y	-0.0619	-0.0204	0.2304	0.0051	0.1993	0.1524	1.0000
specindustry	-0.0412	0.1468	-0.0343	0.4604	-0.0510	-0.0899	-0.0903
equissue	-0.1936	0.3083	-0.0702	0.1506	-0.1787	-0.2470	-0.0777
stdev	0.0885	0.0045	0.8426	0.1185	0.9320	0.0944	0.2350

	specin~y	equissue	stdev
specindustry	1.0000		
equissue	0.2192	1.0000	
stdev	-0.0816	-0.1383	1.0000

APPENDIX 4: REGRESSION RESULTS OF 8 MODELS IN TABLE 11

MODEL 1

```
. reg mabhri37 maari0

      Source |       SS       df       MS              Number of obs =     106
-------------+------------------------------           F(  1,   104) =    0.38
       Model |  .218056016     1  .218056016           Prob > F      =  0.5401
    Residual |  60.0168891   104  .577085472           R-squared     =  0.0036
-------------+------------------------------           Adj R-squared = -0.0060
       Total |  60.2349452   105  .573666144           Root MSE      =  .75966

------------------------------------------------------------------------------
    mabhri37 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      maari0 |  -.2993123   .4869233    -0.61   0.540    -1.264899    .6662749
       _cons |  -.1972054   .0871528    -2.26   0.026    -.3700326   -.0243782
------------------------------------------------------------------------------
```

```
. sktest error3

                    Skewness/Kurtosis tests for Normality
                                                      ------- joint ------
    Variable |  Pr(Skewness)   Pr(Kurtosis)  adj chi2(2)     Prob>chi2
-------------+-------------------------------------------------------
      error3 |        0.206          0.114          4.21        0.1220
```

MODEL 2*

```
. regress mabhri37 maarivol maari0

      Source |       SS       df       MS              Number of obs =     106
-------------+------------------------------           F(  2,   103) =    0.81
       Model |  .933977981     2  .466988991           Prob > F      =  0.4472
    Residual |  59.3009672   103  .575737545           R-squared     =  0.0155
-------------+------------------------------           Adj R-squared = -0.0036
       Total |  60.2349452   105  .573666144           Root MSE      =  .75877

------------------------------------------------------------------------------
    mabhri37 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    maarivol |   1.717931   1.540583     1.12   0.267    -1.337452    4.773314
      maari0 |   -.535772   .5305708    -1.01   0.315    -1.588034     .51649
       _cons |  -.1671457   .0911291    -1.83   0.070    -.3478788    .0135874
------------------------------------------------------------------------------
```

```
. predict error6, resid

. sktest error6

                    Skewness/Kurtosis tests for Normality
                                                      ------- joint ------
    Variable |  Pr(Skewness)   Pr(Kurtosis)  adj chi2(2)     Prob>chi2
-------------+-------------------------------------------------------
      error6 |        0.147          0.193          3.90        0.1421
```

MODEL 3

```
. reg mabhri37  maari0 maarvol grossproceeds assfloat mcafloat

      Source |       SS       df       MS              Number of obs =     106
-------------+------------------------------           F(  5,   100) =    1.28
       Model |  3.62044516     5  .724089032            Prob > F      =  0.2789
    Residual |    56.6145   100     .566145            R-squared     =  0.0601
-------------+------------------------------           Adj R-squared =  0.0131
       Total |  60.2349452   105  .573666144            Root MSE      =  .75243

------------------------------------------------------------------------------
    mabhri37 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      maari0 |   -.561926   .5320348    -1.06   0.293    -1.617468    .4936159
     maarvol |   1.569781   1.538592     1.02   0.310    -1.482741    4.622304
grossproce~s |  -.0002261   .0011059    -0.20   0.838    -.0024201    .0019679
    assfloat |   .0003765   .0003338     1.13   0.262    -.0002858    .0010388
    mcafloat |   .0000603   .0000727     0.83   0.409    -.0000839    .0002045
       _cons |  -.2322366   .1146541    -2.03   0.045    -.4597071   -.0047661
------------------------------------------------------------------------------
```

```
. vif

    Variable |       VIF       1/VIF
-------------+----------------------
grossproce~s |      7.35    0.136031
    mcafloat |      6.86    0.145668
    assfloat |      1.22    0.819508
      maari0 |      1.22    0.821729
     maarvol |      1.21    0.828410
-------------+----------------------
    Mean VIF |      3.57
```

MODEL 3*

```
. reg mabhri37 maari0 maarvol mcafloat assfloat

      Source |       SS       df       MS              Number of obs =     106
-------------+------------------------------           F(  4,   101) =    1.60
       Model |  3.59678664     4  .899196661            Prob > F      =  0.1792
    Residual |  56.6381585   101  .560773847            R-squared     =  0.0597
-------------+------------------------------           Adj R-squared =  0.0225
       Total |  60.2349452   105  .573666144            Root MSE      =  .74885

------------------------------------------------------------------------------
    mabhri37 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      maari0 |  -.5695924   .5281879    -1.08   0.283    -1.617375    .4781904
     maarvol |   1.567816   1.531246     1.02   0.308    -1.469764    4.605397
    mcafloat |   .0000466   .0000281     1.66   0.100    -9.04e-06    .0001023
    assfloat |   .0003501   .0003064     1.14   0.256    -.0002577     .000958
       _cons |  -.2426799   .1021555    -2.38   0.019     -.445329   -.0400308
------------------------------------------------------------------------------

. predict error2i, resid

. sktest error2i

                    Skewness/Kurtosis tests for Normality
                                                      ------- joint ------
    Variable | Pr(Skewness)   Pr(Kurtosis)  adj chi2(2)     Prob>chi2
-------------+-------------------------------------------------------
     error2i |       0.140          0.154          4.32        0.1151

. test mcafloat

 ( 1)  mcafloat = 0

       F(  1,   101) =    2.76
            Prob > F =    0.0997

. test assfloat

 ( 1)  assfloat = 0

       F(  1,   101) =    1.31
            Prob > F =    0.2559
```

MODEL 4*

```
. reg mabhri37 maari0 maarvol assfloat mcafloat avrinc lnage

      Source |       SS       df       MS              Number of obs =     106
-------------+------------------------------           F(  6,    99) =    1.70
       Model |  5.61882731     6  .936471219            Prob > F      =  0.1295
    Residual |  54.6161178    99  .551677958            R-squared     =  0.0933
-------------+------------------------------           Adj R-squared =  0.0383
       Total |  60.2349452   105  .573666144            Root MSE      =  .74275

------------------------------------------------------------------------------
    mabhri37 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      maari0 |   -.6348139   .5272515    -1.20   0.231    -1.680995    .4113675
     maarvol |    1.594599   1.518857     1.05   0.296    -1.419143    4.608341
    assfloat |    .0003485   .0003041     1.15   0.254    -.0002548    .0009519
    mcafloat |    .0000446   .0000293     1.52   0.131    -.0000136    .0001027
      avrinc |    .0018324   .0036342     0.50   0.615    -.0053786    .0090434
       lnage |    .1694654   .0972807     1.74   0.085    -.0235606    .3624914
       _cons |   -.6270063   .2534188    -2.47   0.015    -1.129844   -.1241684
------------------------------------------------------------------------------

. predict error4, resid

. sktest error4

                    Skewness/Kurtosis tests for Normality
                                                       ------ joint ------
    Variable | Pr(Skewness)   Pr(Kurtosis)  adj chi2(2)     Prob>chi2
-------------+-------------------------------------------------------
      error4 |       0.322          0.112          3.60        0.1655

. vif

    Variable |       VIF       1/VIF
-------------+----------------------
      maari0 |      1.23    0.815325
     maarvol |      1.21    0.828355
    mcafloat |      1.15    0.872889
      avrinc |      1.14    0.880547
    assfloat |      1.04    0.962475
       lnage |      1.04    0.964263
-------------+----------------------
    Mean VIF |      1.13
```

MODEL 5

```
. reg mabhri37 maari0 maarvol  stdev assfloat lnage underwriterrank   lnmcafloat

      Source |       SS       df       MS              Number of obs =     106
-------------+------------------------------           F(  7,    98) =    3.02
       Model |  10.6951617     7  1.52788025            Prob > F      =  0.0064
    Residual |  49.5397834    98  .505507994            R-squared     =  0.1776
-------------+------------------------------           Adj R-squared =  0.1188
       Total |  60.2349452   105  .573666144            Root MSE      =  .71099

------------------------------------------------------------------------------
    mabhri37 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      maari0 |   -.3215726   .5554986    -0.58   0.564    -1.423941    .7807963
     maarvol |    1.550525   1.454389     1.07   0.289    -1.335662    4.436712
       stdev |    .0247631   .0067559     3.67   0.000     .0113562    .0381701
    assfloat |    .0004029   .0002985     1.35   0.180    -.0001895    .0009953
       lnage |    .1756251   .0920309     1.91   0.059    -.0070074    .3582575
underwrite~k |    .0820465    .158888     0.52   0.607    -.2332616    .3973546
  lnmcafloat |   -.1598904   .1032821    -1.55   0.125    -.3648504    .0450697
       _cons |    .0162917   .5299536     0.03   0.976    -1.035384    1.067967
------------------------------------------------------------------------------

. predict error6c, resid

. sktest  error6c

                    Skewness/Kurtosis tests for Normality
                                                       ------ joint ------
    Variable | Pr(Skewness)   Pr(Kurtosis)  adj chi2(2)     Prob>chi2
-------------+-------------------------------------------------------
     error6c |       0.198          0.125          4.11        0.1279

. vif

    Variable |       VIF       1/VIF
-------------+----------------------
  lnmcafloat |      2.24    0.447407
      maari0 |      1.49    0.673043
       stdev |      1.46    0.684935
underwrite~k |      1.31    0.765423
     maarvol |      1.21    0.827812
    assfloat |      1.09    0.915194
       lnage |      1.01    0.987242
-------------+----------------------
    Mean VIF |      1.40
```

MODEL 6

```
. reg mabhri37 maari0 maarvol lnage lnmcafloat assfloat  stdev  multinationalit
> y

      Source |       SS       df       MS              Number of obs =     106
-------------+------------------------------           F(  7,    98) =    3.84
       Model |  12.9588181     7  1.85125972            Prob > F      =  0.0010
    Residual |  47.2761271    98   .48240946            R-squared     =  0.2151
-------------+------------------------------           Adj R-squared =  0.1591
       Total |  60.2349452   105  .573666144            Root MSE      =  .69456

------------------------------------------------------------------------------
    mabhri37 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      maari0 |  -.1082066   .5500295    -0.20   0.844    -1.199722    .9833089
     maarvol |   1.485543   1.421089     1.05   0.298    -1.334561    4.305647
       lnage |   .1553391    .090052     1.72   0.088    -.0233661    .3340444
  lnmcafloat |  -.1912948   .0938636    -2.04   0.044    -.3775641   -.0050255
    assfloat |   .0004753   .0002918     1.63   0.107    -.0001038    .0010544
       stdev |   .0229367      .0065     3.53   0.001     .0100377    .0358358
ultinatio~y |   .3865372    .173354     2.23   0.028     .0425217    .7305526
       _cons |   .1665245   .5059821     0.33   0.743    -.8375806    1.170629
------------------------------------------------------------------------------
```

MODEL 7

```
reg mabhri37 maari0 maarvol lnage lnmcafloat assfloat  stdev  multinationalit
y specindustry
```

Source	SS	df	MS		
Model	13.1944639	8	1.64930799	Number of obs	= 106
Residual	47.0404812	97	.484953415	F(8, 97)	= 3.40
				Prob > F	= 0.0017
Total	60.2349452	105	.573666144	R-squared	= 0.2190
				Adj R-squared	= 0.1546
				Root MSE	= .69639

mabhri37	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
maari0	-.1298879	.5523542	-0.24	0.815	-1.226158	.9663824
maarvol	1.424882	1.427486	1.00	0.321	-1.408281	4.258046
lnage	.1537075	.0903195	1.70	0.092	-.0255516	.3329666
lnmcafloat	-.1774204	.0961925	-1.84	0.068	-.3683359	.0134952
assfloat	.0003577	.0003377	1.06	0.292	-.0003126	.001028
stdev	.0230125	.006518	3.53	0.001	.010076	.035949
ultinatio~y	.3888908	.1738433	2.24	0.028	.04386	.7339217
pecindustry	.1583298	.2271343	0.70	0.487	-.292469	.6091286
_cons	.0895265	.5192004	0.17	0.863	-.9409426	1.119996

```
predict error17, resid

sktest error17
```

Skewness/Kurtosis tests for Normality

Variable	Pr(Skewness)	Pr(Kurtosis)	joint adj chi2(2)	joint Prob>chi2
error17	0.425	0.134	2.95	0.2289

```
hettest

reusch-Pagan / Cook-Weisberg test for heteroskedasticity
        Ho: Constant variance
        Variables: fitted values of mabhri37

        chi2(1)      =     0.84
        Prob > chi2  =   0.3597
```

```
. vif
```

Variable	VIF	1/VIF
lnmcafloat	2.02	0.494815
maari0	1.53	0.653049
assfloat	1.46	0.685928
stdev	1.42	0.705929
specindustry	1.37	0.729974
maarvol	1.21	0.824368
multinatio~y	1.16	0.864301
lnage	1.02	0.983333
Mean VIF	1.40	

MODEL 8

```
. reg mabhri37 maari0 maarvol lnage lnmcafloat assfloat  stdev  multinationalit
> y  specindustry equissue

      Source |       SS       df       MS              Number of obs =     106
-------------+------------------------------           F(  9,    96) =    3.08
       Model |  13.489204      9  1.49880044           Prob > F      =  0.0028
    Residual |  46.7457412    96  .486934804           R-squared     =  0.2239
-------------+------------------------------           Adj R-squared =  0.1512
       Total |  60.2349452   105  .573666144           Root MSE      =  .69781

------------------------------------------------------------------------------
    mabhri37 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      maari0 |  -.1135647    .553879    -0.21   0.838    -1.213006    .9858764
     maarvol |   1.521665   1.435798     1.06   0.292    -1.328371    4.371701
       lnage |   .1696827   .0928039     1.83   0.071    -.0145315    .3538969
  lnmcafloat |  -.2201667   .1109485    -1.98   0.050    -.4403978    .0000644
    assfloat |   .0004265   .0003498     1.22   0.226    -.0002678    .0011208
       stdev |   .0238123   .0066117     3.60   0.001     .0106881    .0369366
multinatio~y |   .3977862   .1745729     2.28   0.025     .0512617    .7443106
specindustry |   .1660211   .2278125     0.73   0.468     -.286183    .6182253
    equissue |  -.3428501   .4406767    -0.78   0.438    -1.217586    .5318863
       _cons |   .3857213   .6446781     0.60   0.551    -.8939546    1.665397
------------------------------------------------------------------------------

. predict error18, resid

. sktest error18

                    Skewness/Kurtosis tests for Normality
                                                      ------ joint ------
    Variable | Pr(Skewness)   Pr(Kurtosis)  adj chi2(2)     Prob>chi2
-------------+-------------------------------------------------------
     error18 |       0.434          0.184          2.44        0.2953
```

```
. vif

    Variable |       VIF       1/VIF
-------------+----------------------
  lnmcafloat |      2.68    0.373468
    assfloat |      1.56    0.642053
      maari0 |      1.53    0.652112
    equissue |      1.53    0.653226
       stdev |      1.45    0.688862
specindustry |      1.37    0.728600
     maarvol |      1.22    0.818180
multinatio~y |      1.16    0.860593
       lnage |      1.07    0.935194
-------------+----------------------
    Mean VIF |      1.51

. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of mabhri37

         chi2(1)      =     0.87
         Prob > chi2  =   0.3511
```

APPENDIX 5: REGRESSION RESULTS OF MODELS FOR VARIABLES DELETION TESTS

FULL MODEL

```
. regress mabhri37 maari0 maarvol assfloat lnMcafloat lnage avrinc underwriterra
> nk stdev multinationality specindustry equissue
```

Source	SS	df	MS		
Model	13.7369835	11	1.24881668	Number of obs	= 106
Residual	46.4979617	94	.494659167	F(11, 94)	= 2.52
				Prob > F	= 0.0078
Total	60.2349452	105	.573666144	R-squared	= 0.2281
				Adj R-squared	= 0.1377
				Root MSE	= .70332

mabhri37	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
maari0	-.0849136	.5612342	-0.15	0.880	-1.199257	1.02943
maarvol	1.494152	1.447675	1.03	0.305	-1.380241	4.368545
assfloat	.0003942	.0003564	1.11	0.272	-.0003134	.0011018
lnMcafloat	-.2447177	.1191375	-2.05	0.043	-.481268	-.0081673
lnage	.1789047	.0945604	1.89	0.062	-.0088473	.3666567
avrinc	-.0019672	.003693	-0.53	0.596	-.0092997	.0053653
underwrite~k	.0739528	.1584509	0.47	0.642	-.2406551	.3885607
stdev	.0260319	.0074404	3.50	0.001	.0112588	.040805
multinatio~y	.3909265	.1762337	2.22	0.029	.0410103	.7408426
specindustry	.2026065	.2356857	0.86	0.392	-.265353	.6705661
equissue	-.3138927	.4461089	-0.70	0.483	-1.199652	.571867
_cons	.4287356	.6608712	0.65	0.518	-.8834395	1.740911

```
. predict error1, resid

. sktest error1
```

	Skewness/Kurtosis tests for Normality		joint	
Variable	Pr(Skewness)	Pr(Kurtosis)	adj chi2(2)	Prob>chi2
error1	0.449	0.192	2.33	0.3122

```
. vif
```

Variable	VIF	1/VIF
lnMcafloat	3.04	0.329029
stdev	1.81	0.552595
assfloat	1.59	0.628354
maari0	1.55	0.645206
equissue	1.54	0.647526
specindustry	1.45	0.691533
underwrite~k	1.33	0.753135
avrinc	1.31	0.764597
maarvol	1.22	0.817576
multinatio~y	1.17	0.857845
lnage	1.09	0.915062
Mean VIF	1.55	

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of mabhri37

         chi2(1)      =     1.06
         Prob > chi2  =   0.3033

. test  maari0 maarvol

 ( 1)  maari0 = 0
 ( 2)  maarvol = 0

       F(  2,    94) =     0.55
            Prob > F =     0.5766
```

MODEL 1

```
. regress mabhri37 assfloat lnMcafloat lnage avrinc  underwriterrank stdev multinational
> ity specindustry equissue

      Source |       SS       df       MS              Number of obs =     106
-------------+------------------------------           F(  9,    96) =    2.99
       Model |  13.1890109     9  1.46544565            Prob > F      =  0.0035
    Residual |  47.0459343    96  .490061816           R-squared     =  0.2190
-------------+------------------------------           Adj R-squared =  0.1457
       Total |  60.2349452   105  .573666144           Root MSE      =  .70004

------------------------------------------------------------------------------
    mabhri37 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    assfloat |   .0003917   .0003491     1.12   0.265    -.0003013    .0010847
  lnMcafloat |  -.2243645   .1046911    -2.14   0.035    -.4321748   -.0165543
       lnage |   .1772376   .0939559     1.89   0.062    -.0092634    .3637386
      avrinc |  -.0020558   .0036748    -0.56   0.577    -.0093502    .0052387
underwrite~k |   .0729576   .1568435     0.47   0.643    -.2383743    .3842894
       stdev |   .0256764   .0073159     3.51   0.001     .0111545    .0401984
multinatio~y |   .3863723    .171739     2.25   0.027     .0454732    .7272715
specindustry |   .2207483   .2336418     0.94   0.347    -.2430269    .6845236
    equissue |  -.2669761   .4413145    -0.60   0.547    -1.142978    .6090263
       _cons |   .2911992   .6050631     0.48   0.631    -.9098416     1.49224
------------------------------------------------------------------------------

. vif

    Variable |       VIF       1/VIF
-------------+----------------------
  lnMcafloat |      2.37    0.422140
       stdev |      1.77    0.566251
    assfloat |      1.54    0.648602
    equissue |      1.53    0.655522
specindustry |      1.43    0.697145
underwrite~k |      1.31    0.761507
      avrinc |      1.31    0.765000
multinatio~y |      1.12    0.894940
       lnage |      1.09    0.918260
-------------+----------------------
    Mean VIF |      1.50

. predict error2b, resid

. sktest error2b

                    Skewness/Kurtosis tests for Normality
                                                      ------ joint ------
    Variable | Pr(Skewness)   Pr(Kurtosis)  adj chi2(2)     Prob>chi2
-------------+-------------------------------------------------------
     error2b |       0.549         0.089          3.33        0.1889
```

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of mabhri37

         chi2(1)      =     1.30
         Prob > chi2  =   0.2550

. test equissue

 ( 1)  equissue = 0

       F(  1,    96) =    0.37
            Prob > F =    0.5466
```

MODEL 2

```
. regress mabhri37 assfloat lnMcafloat lnage avrinc   underwriterrank stdev multinationa
> lity specindustry

      Source |       SS       df       MS              Number of obs =     106
-------------+------------------------------           F(  8,    97) =    3.34
       Model |  13.0096618     8  1.62620772            Prob > F      =  0.0020
    Residual |  47.2252834    97  .486858592           R-squared     =  0.2160
-------------+------------------------------           Adj R-squared =  0.1513
       Total |  60.2349452   105  .573666144           Root MSE      =  .69775

------------------------------------------------------------------------------
    mabhri37 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    assfloat |   .0003376   .0003364     1.00   0.318      -.00033    .0010052
  lnMcafloat |  -.1953192    .092728    -2.11   0.038    -.3793586   -.0112798
       lnage |   .1654726   .0916203     1.81   0.074    -.0163683    .3473134
      avrinc |  -.0022315   .0036513    -0.61   0.543    -.0094784    .0050153
underwrite~k |   .0780138   .1561079     0.50   0.618    -.2318172    .3878448
       stdev |   .0252889    .007264     3.48   0.001     .010872    .0397059
multinatio~y |   .3801845   .1708729     2.22   0.028     .0410491     .71932
specindustry |   .2163509   .2327642     0.93   0.355    -.2456216    .6783234
       _cons |   .0762941   .4881981     0.16   0.876     -.892644    1.045232
------------------------------------------------------------------------------

. vif

    Variable |       VIF       1/VIF
-------------+----------------------
  lnMcafloat |      1.87    0.534573
       stdev |      1.75    0.570625
    assfloat |      1.44    0.694184
specindustry |      1.43    0.697820
underwrite~k |      1.31    0.763676
      avrinc |      1.30    0.769812
multinatio~y |      1.11    0.898126
       lnage |      1.04    0.959363
-------------+----------------------
    Mean VIF |      1.41
```

```
. predict error3, resid

. sktest error3

                    Skewness/Kurtosis tests for Normality
                                                      ------- joint ------
    Variable | Pr(Skewness)   Pr(Kurtosis)  adj chi2(2)     Prob>chi2
-------------+-------------------------------------------------------
      error3 |       0.540          0.067          3.83        0.1476
```

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of mabhri37

         chi2(1)      =     1.25
         Prob > chi2  =   0.2642

. test underwriterrank

 ( 1)  underwriterrank = 0

       F(  1,    97) =    0.25
            Prob > F =    0.6184
```

MODEL 3

```
. regress mabhri37 assfloat lnMcafloat lnage avrinc stdev multinationality specindustry

      Source |       SS       df       MS              Number of obs =     106
-------------+------------------------------           F(  7,    98) =    3.81
       Model |  12.8880722     7  1.84115317            Prob > F      =  0.0011
    Residual |  47.3468729    98  .483131356           R-squared     =  0.2140
-------------+------------------------------           Adj R-squared =  0.1578
       Total |  60.2349452   105  .573666144           Root MSE      =  .69508

------------------------------------------------------------------------------
    mabhri37 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   assfloat |   .0003629   .0003313     1.10   0.276    -.0002944    .0010203
  lnMcafloat |  -.1771538   .0849793    -2.08   0.040    -.3457926   -.0085151
       lnage |   .1621795   .0910325     1.78   0.078    -.0184716    .3428305
      avrinc |   -.002237   .0036373    -0.62   0.540    -.0094551    .0049811
      stdev |   .0246947   .0071385     3.46   0.001     .0105286    .0388608
multinatio~y |   .3858367   .1698443     2.27   0.025     .0487863    .7228872
specindustry |   .2031028   .2303628     0.88   0.380    -.2540446    .6602502
       _cons |   .0198333   .4731237     0.04   0.967    -.9190653    .9587319
------------------------------------------------------------------------------

. vif

    Variable |       VIF       1/VIF
-------------+----------------------
       stdev |      1.71    0.586336
  lnMcafloat |      1.58    0.631632
specindustry |      1.41    0.706991
   assfloat |      1.41    0.710289
      avrinc |      1.30    0.769818
multinatio~y |      1.11    0.902078
       lnage |      1.04    0.964352
-------------+----------------------
    Mean VIF |      1.37

. predict error4, resid

. sktest error4

                    Skewness/Kurtosis tests for Normality
                                                      ------ joint ------
    Variable | Pr(Skewness)   Pr(Kurtosis)  adj chi2(2)     Prob>chi2
-------------+-------------------------------------------------------
      error4 |       0.549          0.055          4.14        0.1264
```

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of mabhri37

         chi2(1)      =     1.21
         Prob > chi2  =   0.2723

. test avrinc

 ( 1)  avrinc = 0

       F(  1,    98) =    0.38
            Prob > F =    0.5400
```

MODEL 4

```
. regress mabhri37 assfloat lnMcafloat lnage stdev multinationality specindustry

      Source |       SS       df       MS              Number of obs =     106
-------------+------------------------------           F(  6,    99) =    4.41
       Model |  12.7053265     6  2.11755442            Prob > F      =  0.0005
    Residual |  47.5296186    99  .480097158            R-squared     =  0.2109
-------------+------------------------------           Adj R-squared =  0.1631
       Total |  60.2349452   105  .573666144            Root MSE      =  .69289

------------------------------------------------------------------------------
    mabhri37 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    assfloat |   .0003697     .00033     1.12   0.265    -.0002851    .0010246
  lnMcafloat |  -.1675057   .0832561    -2.01   0.047    -.3327039   -.0023074
       lnage |   .1532997   .0895976     1.71   0.090    -.0244813    .3310807
       stdev |   .0227949   .0064153     3.55   0.001     .0100656    .0355241
multinatio~y |   .3888913   .1692377     2.30   0.024      .053087    .7246956
specindustry |   .1742119    .224813     0.77   0.440    -.271866    .6202898
       _cons |   .0149138   .4715683     0.03   0.975     -.92078    .9506076
------------------------------------------------------------------------------

. vif

    Variable |       VIF       1/VIF
-------------+----------------------
  lnMcafloat |      1.53    0.653916
    assfloat |      1.41    0.711086
       stdev |      1.39    0.721432
specindustry |      1.36    0.737665
multinatio~y |      1.11    0.902850
       lnage |      1.01    0.989236
-------------+----------------------
    Mean VIF |      1.30

. predict error5, resid

. sktest error5

                    Skewness/Kurtosis tests for Normality
                                                      ------- joint ------
    Variable | Pr(Skewness)   Pr(Kurtosis)  adj chi2(2)     Prob>chi2
-------------+-------------------------------------------------------
      error5 |       0.528          0.065          3.91        0.1413

. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of mabhri37

         chi2(1)      =     1.04
         Prob > chi2  =   0.3080
```

```
 test specindustry

( 1)  specindustry = 0

       F(  1,     99) =     0.60
            Prob > F =     0.4402
```

MODEL 5

```
. regress mabhri37 assfloat lnMcafloat lnage stdev multinationality

      Source |       SS       df       MS              Number of obs =     106
-------------+------------------------------           F(  5,   100) =    5.19
       Model |  12.4170284     5  2.48340569            Prob > F      =  0.0003
    Residual |  47.8179167   100  .478179167           R-squared     =  0.2061
-------------+------------------------------           Adj R-squared =  0.1665
       Total |  60.2349452   105  .573666144           Root MSE      =  .69151

------------------------------------------------------------------------------
    mabhri37 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   assfloat |   .0004975   .0002853     1.74   0.084    -.0000686    .0010636
  lnMcafloat |  -.1797134   .0815887    -2.20   0.030     -.341583   -.0178438
       lnage |   .1554952   .0893737     1.74   0.085    -.0218196    .3328101
       stdev |    .022645   .0063995     3.54   0.001     .0099486    .0353415
multinatio~y |   .3841948    .168791     2.28   0.025     .0493183    .7190713
       _cons |   .0850247   .4618823     0.18   0.854    -.8313366    1.001386
------------------------------------------------------------------------------

. vif

    Variable |       VIF       1/VIF
-------------+----------------------
  lnMcafloat |      1.47    0.678198
       stdev |      1.38    0.722088
multinatio~y |      1.11    0.904009
   assfloat |      1.06    0.947537
       lnage |      1.01    0.990226
-------------+----------------------
    Mean VIF |      1.21

. predict error6, resid

. sktest error6

                    Skewness/Kurtosis tests for Normality
                                                      ------ joint ------
    Variable | Pr(Skewness)   Pr(Kurtosis)  adj chi2(2)     Prob>chi2
-------------+-------------------------------------------------------
      error6 |       0.449         0.093          3.47        0.1760

. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of mabhri37

         chi2(1)      =     0.80
         Prob > chi2  =   0.3709
```

APPENDIX 6: DATA OF THE IPO SAMPLE

6a/ Aabnormal initial and long-term performance

No	Company	*Stock*	Publ Date	Pi,0	Pi,1	MAARi,0	MABHRi37
	Comstock Homebuilding	*CHCI*	14/12/2004	***OUTLIER***			
1	ACADIA Pharmaceuticals	*ACAD*	27/05/2004	8	7.65	-0.0446	0.580
2	Affirmative Insurance	*AFFM*	09/07/2004	7	7.21	0.0015	-0.434
3	Allion Healthcare inc	*ALLI*	22/06/2005	14	18.7	0.2414	-1.268
4	Alnylam Pharmaceuticals	*ALNY*	28/05/2004	15	15.7	0.0011	0.546
5	Anadys Pharmaceuticals	*ANDS*	26/03/2004	14	13.5	0.0103	-0.841
6	Arbinet Corporation	*ARBX*	16/12/2004	17.5	29	0.5148	-1.582
7	Auxilium Pharmaceuticals	*AUXL*	23/07/2004	7	7.1	-0.0276	0.726
8	Beacon Roofing Supply	*BECN*	23/09/2004	13	14.9	0.2074	-0.986
9	BioDelivery Sciences	*BDSI*	26/07/2002	14	13.1	-0.5152	-0.590
10	Blackbaud, Inc.	*BLKB*	22/07/2004	12	16.4	0.0571	0.740
11	Blackboard Inc.	*BBBB*	18/06/2004	16	15.4	0.3511	0.587
12	Blue Nile, Inc	*NILE*	20/05/2004	13	16.5	0.3303	0.327
13	Bofl Holding, Inc.	*BOFI*	16/03/2005	14	13.3	0.0062	-0.814
14	Buffalo Wild Wings	*BWLD*	18/11/2003	14	17.4	0.3264	0.656
15	Builders Firstsource	*BLDR*	22/06/2005	13	16.1	-0.0333	-1.269
16	Callidus Software Inc.	*CALD*	20/11/2003	12	11.8	0.2187	-1.207
17	Cascade Microtech, Inc	*CSCD*	15/12/2004	17	24.7	-0.0193	-0.485
18	Citi Trend	*CTRN*	18/05/2005	21.5	22.5	0.1026	0.185
19	Cogent, Inc	*COGT*	24/09/2004	13	16	0.4114	-0.684
20	Community Bancorp	*CBON*	10/12/2004	11	10.6	0.2398	-0.829
21	Conn's, Inc.	*CONN*	25/11/2003	15	14.5	0.0746	0.178
22	Copano Energy, L.L.C.	*CPNO*	09/11/2004	7	7.06	0.1243	0.239
23	Cornerstone Therapeutics	*CRTX*	27/05/2004	23	29.4	0.0133	-1.426
24	Cosi, Inc.	*COSI*	22/11/2002	11.5	11.5	0.0707	-0.184
25	Crosstex Energy, Inc.	*XTXI*	13/01/2004	9.5	9.57	0.2744	-0.192
26	Crosstex Energy, L.P.	*XTEX*	12/12/2002	6	5.95	0.0104	-0.145
27	Cutera, Inc	*CUTR*	31/03/2004	16	22	0.0035	0.459
28	Cytokinetics	*CYTK*	29/04/2004	14	14.1	0.2318	-1.184
29	Design Within Reach	*DWRI*	30/06/2004	12	11.7	0.3082	-1.317
30	DexCom	*DXCM*	14/04/2005	9	10.1	-0.0080	-0.721
31	Digirad Corporation	*DRAD*	10/06/2004	12	18	-0.0209	-1.110

32	Dollar Financial Corp.	*DLLR*	28/01/2005	19	26.8	0.0082	0.361
33	DreamWorks Animation	*DWA*	28/10/2004	6	5.85	0.3167	-0.545
34	DryShips Inc	*DRYS*	03/02/2005	7.5	9.4	0.1195	1.107
35	DTS, Inc.	*DTSI*	10/07/2003	5.5	3.3	0.3950	-0.461
36	Dynavax	*DVAX*	19/02/2004	28	38.8	0.2535	-0.595
37	Entorian Technologies	*ENTN*	06/02/2004	20	20.2	0.1143	-1.363
38	EV3 Inc	*EVVV*	16/06/2005	18	24.9	0.0044	-0.467
39	Freightcar America	*RAIL*	06/04/2005	14	13.8	0.0929	0.316
40	Gander Mountain	*GMTN*	21/04/2004	6	6.9	0.3138	-0.745
41	Google Inc.	*GOOG*	16/08/2004	14	14.2	0.1507	1.224
42	GTx, Inc.	*GTXI*	03/02/2004	17	24.9	-0.1177	0.484
43	Heritage Financial	*HBOS*	30/06/2005	17	21	0.0802	-0.120
44	Hiland Partners, LP	*HLND*	10/02/2005	14	14	0.2588	0.382
45	Idenix Pharmaceuticals	*IDIX*	22/07/2004	9.5	8.59	-0.0485	-1.662
46	Inergy Holdings, LP	*NRGP*	21/06/2005	8.5	8.5	0.2106	0.088
47	Infinity	*IPCC*	12/02/2003	8	8.05	0.0040	0.339
48	InfoSonics Corporation	*IFON*	17/06/2004	7	6.66	-0.0204	-0.629
49	Inhibitex, Inc.	*INHX*	04/06/2004	6.5	8.88	0.0317	-1.904
50	Intersections Inc.	*INTX*	30/04/2004	14	15.2	0.4042	-1.061
51	iPass Inc.	*IPAS*	24/07/2003	19.5	25.4	0.3114	-1.764
52	Kirkland's, Inc	*KIRK*	11/07/2002	7	7.6	-0.0614	-0.874
53	Leadis Technology	*LDIS*	16/06/2004	20.5	21.6	-0.0670	-1.348
54	LECG Corporation	*XPRT*	14/11/2003	20	20.1	0.2360	-0.437
55	LHC Group	*LHCG*	09/06/2005	8	7.82	0.2143	0.170
56	Lincoln Education	*LINC*	23/06/2005	10	10.8	0.0199	-0.538
57	Local.com Corporation	*LOCM*	19/10/2004	14	17.7	-0.0340	-2.047
58	Manitex International	*MNTX*	15/02/2005	8	8.08	0.1367	-0.484
59	MannKind Corporation	*MNKD*	28/07/2004	14	16.2	0.0074	-0.737
60	Marchex, Inc.	*MCHX*	31/03/2004	10	9.5	0.3165	-0.297
61	Market Leader, Inc.	*LEDR*	10/12/2004	14	13.3	0.0448	-1.746
62	Marlin Business Services	*MRLN*	12/11/2003	7	7	0.1216	-0.038
63	Martin Midstream	*MMLP*	01/11/2002	22.5	27.8	-0.0976	0.115
64	Mercer Insurance Group	*MIGP*	16/12/2003	19	17.7	0.1909	0.176
65	Metabasis Therapeutics	*MBRX*	16/06/2004	13	13.8	-0.0503	-0.300
66	Micrus Endovascular	*MEND*	16/06/2005	11	11	-0.0052	0.149
67	Monolithic Power Systems	*MPWR*	19/11/2004	12	10.8	0.0068	0.638
68	Morningstar, Inc	*MORN*	03/05/2005	14	17.1	0.0758	0.818
69	National Interstate	*NATL*	28/01/2005	10	12.2	0.1527	0.307

70	NETGEAR, Inc.	*NTGR*	31/07/2003	14	15	0.2343	-0.116
71	NetLogic Microsystems	*NETL*	09/07/2004	14	15.7	-0.0416	0.816
72	NeuroMetrix, Inc	*NURO*	22/07/2004	6	6.75	-0.0026	-0.353
73	Nexstar Broadcasting Group	*NXST*	24/11/2003	16.5	20.3	-0.0742	-1.262
74	NuVasive, Inc	*NUVA*	13/05/2004	7.5	9.2	0.0317	0.554
75	Ohio Legacy Corp	*OLCB*	19/12/2002	20	22.7	0.0033	-0.365
76	optionsXpress Holdings	*OXPS*	27/01/2005	11	12	0.2047	0.224
77	Phase Forward Incorporated	*PFWD*	15/07/2004	13.5	15.6	0.2252	0.535
78	Pinnacle Airlines Corp.	*PNCL*	22/11/2003	19	21	-0.0523	0.018
79	Portec Rail Products, Inc.	*PRPX*	27/01/2004	20.5	28.4	-0.0368	-0.012
80	QC Holdings, Inc.	*QCCO*	16/07/2004	16	15.9	0.1073	-0.210
81	Red Robin Gourmet Burgers	*RRGB*	16/07/2002	16	16	0.0557	0.846
82	Republic Airways Holdings	*RJET*	27/05/2004	22.5	29.1	0.0554	0.141
83	RightNow Technologies	*RNOW*	05/08/2004	7	7.5	0.0196	0.032
84	Safety Insurance Group	*SAFT*	22/11/2002	12	14	0.0609	0.615
85	Santarus, Inc.	*SNTS*	01/04/2004	14	14	0.1051	-0.700
86	Senomyx, Inc.	*SNMX*	22/06/2004	14.5	12.9	0.1074	0.190
87	Specialty Underwriters' Alliance	*SUAI*	18/11/2004	7.5	9.35	0.0035	-0.773
88	Standard Parking	*STAN*	23/05/2004	13	18.5	0.0617	0.747
89	Stereotaxis, Inc	*STXS*	12/08/2004	6	6.01	-0.0126	-0.127
90	StoneMor Partners L.P	*STON*	15/09/2004	11	11.4	0.0589	-0.169
91	Syneron Medical Ltd.	*ELOS*	06/08/2004	7	6.7	-0.0946	0.157
92	Tessera Technologies	*TSRA*	10/11/2003	14	20	0.3742	0.536
93	Texas Capital Bancshares	*TCBI*	13/08/2003	12	12.9	0.0905	0.298
94	Texas Roadhouse, Inc.	*TXRH*	05/10/2004	8.5	8.5	0.0409	-0.997
95	The Providence Service	*PRSC*	19/08/2003	17	23	0.1449	0.457
96	TOP Ships Inc.	*TOPs*	23/07/2004	7.5	7.2	-0.0237	-0.937
97	Tower Group, Inc	*TWGP*	21/10/2004	8	8.55	0.0443	0.926
98	Tri-S Security Corporation	*TRIS*	09/02/2005	11.5	12.5	0.0092	-0.771
99	Ultra Clean Holdings	*UCTT*	25/03/2004	12	11.5	0.0811	0.448
100	Volcom	*VLCM*	30/06/2005	18.5	20.1	0.3527	-0.676
101	Volterra Semiconductor	*VLTR*	30/07/2004	12	12.2	0.0052	-0.086

102	Warren Resources, Inc	*WRES*	17/12/2004	8.5	8.95	0.2085	0.234
103	WCA Waste Corporation	*WCAA*	23/06/2004	18	20.2	-0.1135	-0.372
104	Wynn Resorts, Limited	*WYNN*	25/10/2002	13	13	0.0043	1.112
105	XenoPort	*XNPT*	02/06/2005	10.5	10.4	-0.0135	1.177
106	Zumiez	*ZUMZ*	06/05/2005	85	100	0.3186	-0.527

6b/ Firms' Age, size, earnings ; stock volatility, and equity sold

No	Stock	*G-PROCEEDS*	*ASSFLOAT*	MCAFLOAT	AGE	AVRINC	STDEV	EQUISSUE
1	*ACAD*	*35.00*	*23*	112.83	11	-13.789	2.771	0.297
2	*AFFM*	*114.38*	*244*	225.58	6	10.107	1.426	0.508
3	*ALLI*	*52.00*	*12*	196.19	22	-2.006	4.593	0.336
4	*ALNY*	*30.00*	*26*	115.87	5	-14.959	5.046	0.259
5	*ANDS*	*43.75*	*23*	151.37	12	-20.358	3.428	0.292
6	*ARBX*	*114.45*	*57*	694.84	8	-22.707	5.680	0.273
7	*AUXL*	*41.25*	*29*	148.25	5	-22.290	4.278	0.267
8	*BECN*	*175.50*	*266*	421.50	76	3.980	7.655	0.512
9	*BDSI*	*11.00*	*1*	23.10	5	-2.559	0.657	0.286
10	*BLKB*	*72.80*	*129*	360.13	22	8.023	5.223	0.216
11	*BBBB*	*77.00*	*80*	502.05	7	-28.287	7.281	0.219
12	*NILE*	*76.67*	*47*	492.46	5	7.084	7.195	0.216
13	*BOFI*	*25.88*	*299*	86.25	6	1.642	1.096	0.300

14	*BWLD*	*51.00*	*41*	176.03	11	2.780	7.064	0.391
15	*BLDR*	*196.00*	*617*	504.12	7	19.869	5.869	0.375
16	*CALD*	*70.00*	*19*	390.65	7	-21.801	4.179	0.222
17	*CSCD*	*74.20*	*42*	148.91	21	-0.175	1.785	0.489
18	*CTRN*	*53.90*	*38*	188.24	59	4.468	11.226	0.321
19	*COGT*	*216.00*	*25*	1402.44	14	3.686	6.911	0.231
20	*CBON*	*50.60*	*389*	179.92	9	4.366	4.266	0.359
21	*CONN*	*58.10*	*164*	339.00	23	20.086	7.906	0.184
22	*CPNO*	*100.00*	*158*	239.71	12	-0.769	10.538	0.473
23	*CRTX*	*42.00*	*23*	169.76	4	-8.831	2.074	0.251
24	*COSI*	*38.92*	*31*	125.93	3	-24.084	2.439	0.336
25	*XTXI*	*45.05*	*97*	297.94	12	1.426	21.725	0.197
26	*XTEX*	*40.00*	*190*	42.21	10	-0.598	6.785	0.952
27	*CUTR*	*49.42*	*17*	141.26	6	2.035	7.669	0.350
28	*CYTK*	*75.40*	*66*	415.38	7	-23.880	2.353	0.225
29	*DWRI*	*49.20*	*17*	211.13	6	1.820	4.902	0.319
30	*DXCM*	*56.40*	*27*	295.73	6	-7.965	3.979	0.187
31	*DRAD*	*66.00*	*33*	211.86	19	-11.454	2.015	0.306
32	*DLLR*	*120.00*	*313*	293.44	15	-13.340	7.281	0.409
33	*DWA*	*812.00*	*718*	4095.49	19	-69.991	4.674	0.274
34	*DRYS*	*234.00*	*108*	600.95	1	15.230	28.709	0.437
35	*DTSI*	*65.28*	*21*	314.49	13	3.353	4.268	0.304
36	*DVAX*	*45.00*	*25*	222.50	8	-14.988	1.361	0.253
37	*ENTN*	*130.00*	*47*	749.65	1	9.201	2.320	0.198
38	*EVVV*	*164.78*	*201*	602.22	5	-123.796	3.480	0.277

39	*RAIL*	*142.50*	*158*	263.51	104	-13.636	12.298	0.599
40	*GMTN*	*91.52*	*187*	278.33	17	-6.371	5.156	0.453
41	*GOOG*	*1666.85*	*414*	27211.50	6	70.763	125.119	0.072
42	*GTXI*	*78.30*	*8*	317.21	7	-7.914	3.080	0.220
43	*HBOS*	*39.70*	*330*	137.17	50	2.459	1.997	0.311
44	*HLND*	*45.00*	*41*	79.02	15	1.360	7.129	0.735
45	*IDIX*	*81.20*	*41*	642.64	6	-35.857	6.580	0.121
46	*NRGP*	*76.50*	*394*	542.41	9	9.406	6.438	0.174
47	*IPCC*	*198.08*	*1,699*	323.57	1	1.833	5.425	0.608
48	*IFON*	*12.00*	*8*	30.42	10	0.497	4.913	0.385
49	*INHX*	*35.00*	*22*	126.18	3	-16.018	3.385	0.286
50	*INTX*	*106.25*	*37*	418.67	8	3.206	3.529	0.369
51	*IPAS*	*98.00*	*55*	1092.94	7	-11.002	4.555	0.120
52	*KIRK*	*90.00*	*107*	257.21	36	1.509	3.502	0.337
53	*LDIS*	*84.00*	*27*	359.07	4	3.652	2.584	0.219
54	*XPRT*	*113.39*	*69*	414.71	15	-8.685	2.361	0.338
55	*LHCG*	*56.00*	*32*	276.85	11	7.419	4.348	0.247
56	*LINC*	*80.00*	*132*	498.40	59	6.841	2.026	0.162
57	*LOCM*	*22.00*	*2*	44.68	5	-1.216	5.322	0.471
58	*MNTX*	*15.00*	*8*	31.05	12	0.712	1.388	0.556
59	*MNKD*	*87.50*	*161*	456.05	13	-35.517	3.318	0.193
60	*MCHX*	*26.00*	*34*	215.61	1	-89.783	3.934	0.165
61	*LEDR*	*93.75*	*8*	390.51	5	1.185	4.535	0.252
62	*MRLN*	*61.60*	*275*	173.61	6	1.657	2.577	0.409
63	*MMLP*	*57.00*	*105*	53.10	51	2.579	4.720	1.000

64	*MIGP*	*56.30*	*96*	83.11	21	2.870	3.773	0.823
65	*MBRX*	*55.09*	*26*	119.01	5	-8.636	1.744	0.440
66	*MEND*	*35.75*	*19*	150.73	9	-4.300	5.131	0.237
67	*MPWR*	*46.75*	*17*	194.06	7	-3.222	4.761	0.241
68	*MORN*	*140.79*	*182*	770.92	20	-0.881	15.051	0.198
69	*NATL*	*51.98*	*224*	294.15	16	9.780	5.071	0.204
70	*NTGR*	*98.00*	*90*	481.70	7	-2.274	3.528	0.257
71	*NETL*	*69.36*	*36*	216.39	9	-22.402	9.251	0.307
72	*NURO*	*24.00*	*8*	93.14	8	-5.726	10.470	0.259
73	*NXST*	*140.00*	*382*	333.37	7	-32.048	3.125	0.397
74	*NUVA*	*71.50*	*18*	265.62	7	-14.380	5.126	0.279
75	*OLCB*	*8.50*	*35*	16.75	3	-0.998	1.397	0.508
76	*OXPS*	*198.00*	*16*	1248.25	5	12.290	5.353	0.195
77	*PFWD*	*39.38*	*79*	294.15	7	-10.909	3.266	0.167
78	*PNCL*	*271.60*	*121*	291.14	18	22.710	2.969	0.886
79	*PRPX*	*20.00*	*2*	80.94	7	1.234	2.515	0.235
80	*QCCO*	*70.00*	*52*	309.62	8	9.219	1.659	0.245
81	*RRGB*	*60.48*	*122*	182.92	33	9.178	14.725	0.335
82	*RJET*	*65.00*	*419*	350.45	8	19.040	3.191	0.196
83	*RNOW*	*44.10*	*24*	199.43	6	-7.404	2.479	0.221
84	*SAFT*	*76.20*	*821*	178.28	23	16.661	9.055	0.459
85	*SNTS*	*54.00*	*29*	286.03	8	-15.591	2.521	0.212
86	*SNMX*	*36.00*	*30*	166.59	6	-17.501	2.826	0.243
87	*SUAI*	*120.65*	*262*	137.43	22	1.257	1.292	0.884
88	*STAN*	*47.15*	*205*	318.13	75	-18.802	9.098	0.161

89	*STXS*	*40.00*	*34*	200.66	14	-20.834	1.819	0.195
90	*STON*	*75.24*	*357*	91.58	5	-6.914	2.052	0.866
91	*ELOS*	*66.00*	*12*	235.86	4	3.148	6.736	0.251
92	*TSRA*	*97.50*	*26*	699.86	13	-24.026	7.839	0.198
93	*TCBI*	*66.00*	*1,289*	291.00	5	-1.103	3.347	0.247
94	*TXRH*	*188.13*	*124*	744.55	11	15.796	8.005	0.264
95	*PRSC*	*51.60*	*13*	108.36	7	0.214	5.706	0.556
96	*TOPs*	*146.63*	*36*	193.77	4	1.204	5.142	0.729
97	*TWGP*	*110.50*	*199*	170.77	14	4.091	8.361	0.681
98	*TRIS*	*10.80*	*6*	20.23	4	0.375	0.990	0.529
99	*UCTT*	*42.00*	*40*	121.88	13	0.384	3.496	0.369
100	*VLCM*	*89.11*	*24*	625.35	14	15.489	7.784	0.201
101	*VLTR*	*36.00*	*18*	187.38	8	-8.867	2.803	0.194
102	*WRES*	*45.00*		270.57	14	-11.492	1.982	0.204
103	*WCAA*	*85.50*	*118* *119*	125.33	4	0.000	1.175	0.617
104	*WYNN*	*449.80*	*389*	970.55	29	-17.726	18.373	0.464
105	*XNPT*	*52.50*	*58*	199.80	6	-26.278	14.635	0.260
106	*ZUMZ*	*56.34*	*40*	327.79	18	3.337	10.803	0.237

6c/ Underwriter and Industry code

Stock	Underwriter	Rank	Industry code
ACAD	Banc of America Securities	7	2834 - Pharmaceutical Preparations
AFFM	Piper Jaffray & Co.	8	6331 - Fire, Marine, and Casualty Insurance
ALLI	Thomas Weisel Partners LLC	8	5122 Drug distribution
ALNY	Banc of America Securities	6	2834 - Pharmaceutical Preparations
ANDS	SG Cowen Securities	9	2834 - Pharmaceutical Preparations
ARBX	Merrill Lynch	9	7389 - Business Services
AUXL	Deutsche Bank Securities	9	2834 - Pharmaceutical Preparations
BECN	J.P. Morgan Securities Inc.	9	5030 - Lumber And Construction Materials
BDSI	Kashner Davidson Securities	9	2834 - Pharmaceutical Preparations
BLKB	J.P. Morgan Securities Inc.	9	7372 - Prepackaged Software
BBBB	Credit Suisse First Boston	9	7372 - Prepackaged Software
NILE	Merrill Lynch, Pierce	7	5944 - Jewelry Stores
BOFI	W.R. Hambrecht & Co	7	6035 - Savings Institutions
BWLD	RBC Dain Rauscher Inc	9	5812 - Eating Places
BLDR	UBS Securities LLC	9	5211 Lumber and building material; retail
CALD	Citigroup Global Markets	8	7371 - Computer Programming Services
CSCD	Lehman Brothers Inc	8	3825 - Instruments for Measuring
CTRN	CIBC World Markets Corp	9	5600 - Retail-apparel service
COGT	Morgan Stanley & Co.	7	7373 - Computer Integrated Systems Design
CBON	Keefe, Bruyette & Woods	6	6021 - National Commercial Banks
CONN	Stephens Inc.	7	5731 - Consumer Electronics Stores
CPNO	RBC Capital Markets	7	4924 - Natural Gas Distribution
CRTX	SG Cowen Securities	7	2834 - Pharmaceutical Preparations

COSI	William Blair & Company	7	5812 - Eating Places
XTXI	A.G. Edwards & Sons, Inc	7	5172 - Petroleum Products Wholesalers
XTEX	A.G. Edwards & Sons, Inc.	7	5172 - Petroleum Products Wholesalers
CUTR	Piper Jaffray & Co.	7	3845 - Electromedical Apparatus
CYTK	Goldman, Sachs & Co.	9	2834 - Pharmaceutical Preparations
DWRI	CIBC World Markets Corp	8	5020 - Furniture And Home Furnishings
DXCM	Piper Jaffray & Co.	7	3841 - Surgical and Medical Instruments
DRAD	Merrill Lynch	9	3845 - Electromedical Apparatus
DLLR	Piper Jaffray & Co	7	6099 - Functions Related to Depository Banking
DWA	Goldman, Sachs & Co.	9	7812 - Motion Picture Video Tape Production
DRYS	Cantor Fitzgerald & Co.	6	4412 - Deep Sea Foreign Transportation of Freight
DTSI	SG Cowen Securities Corp	6	3651 - Video Equipment
DVAX	Bear, Stearns & Co. Inc.	8	2834 - Pharmaceutical Preparations
ENTN	Morgan Stanley & Co.	9	3674 - Semiconductors and Related Devices
EVVV	Piper Jaffray & Co.	7	3841 surgical n medical instruments
RAIL	UBS Securities LLC	9	3743 Rail equipment, transportation
GMTN	Banc of America Securities	8	5940 - Miscellaneous Shopping Goods Stores, retail
GOOG	Morgan Stanley & Co.	9	7370 - Computer Programming, Data Processing
GTXI	Goldman, Sachs & Co.	9	2834 - Pharmaceutical Preparations
HBOS	Keefe, Bruyette & Woods,	7	6035 savings banks
HLND	A.G. Edwards & Sons, Inc.	7	4924 - Natural Gas Distribution
IDIX	Goldman, Sachs & Co.	9	2834 - Pharmaceutical Preparations
NRGP	Lehman Brothers Inc	8	5960 Nonstore retailers, oil well equipment
IPCC	Credit Suisse First Boston	9	6331 - Fire, Marine, and Casualty Insurance
IFON	Gilford Securities	1	5065 - Electronic Parts and Equipment

INHX	Thomas Weisel Partners LLC	8	2836 - Biological Products
INTX	Deutsche Bank Securities	9	7374 - Computer Processing Data Preparation
IPAS	Morgan Stanley & Co.	9	7374 - Computer Processing Data Preparation
KIRK	Merrill Lynch, Pierce	9	5990 - Retail Stores, Not Elsewhere Classified
LDIS	Goldman, Sachs & Co	9	3674 - Semiconductors and Related Devices
XPRT	UBS Securities LLC	9	8742 - Management Consulting Services
LHCG	Jefferies & Company, Inc.	5	8082 - Healthcare facilities
LINC	Merrill Lynch	9	8200 - School, educational service
LOCM	Roth Capital Partners	4	7389 - Business Services
MNTX	Anderson & Strudwick, Inc.	3	3559 - Special Industry Machinery
MNKD	UBS Securities LLC	9	2834 - Pharmaceutical Preparations
MCHX	National Securities	9	7389 - Business Services Marketing online
LEDR	Credit Suisse First Boston	9	7310 - Advertising
MRLN	U.S. Bancorp Piper Jaffray	7	7359 - Equipment Rental and Leasing
MMLP	Raymond James & Assosiate	7	5171 - Petroleum Bulk stations and Terminals
MIGP	Sandler O'Neill & Partners	8	6331 - Fire, Marine, and Casualty Insurance,
MBRX	SG Cowen Securities Corp	6	2834 - Pharmaceutical Preparations
MEND	A.G. Edwards & Sons, Inc	7	3841 surgical n medical instruments
MPWR	Goldman, Sachs & Co.	9	3674 - Semiconductors and Related Devices
MORN	W.R. Hambrecht & Co	7	6282 - Investment advice, computer service
NATL	Merrill Lynch	9	6331 - Fire, Marine, and Casualty Insurance
NTGR	Lehman Brothers Inc	9	3661 - Telephone and Telegraph Apparatus
NETL	Merrill Lynch	9	3674 - Semiconductors and Related Devices
NURO	Punk, Ziegel & Company	9	3841 - Surgical and Medical Instruments
NXST	Bear, Stearns & Co. Inc.	8	4833 - Television Broadcasting Stations

NUVA	Banc of America Securities	8	3841 - Surgical and Medical Instruments
OLCB	Friedman, Billings, Ramsey	5	6021 - National Commercial Banks
OXPS	Goldman, Sachs & Co.	9	6211 - Dealers, and Flotation Companies
PFWD	Thomas Weisel Partners	8	2834 - Pharmaceutical Preparations
PNCL	Morgan Stanley & Co.	9	4512 - Air Transportation, Scheduled
PRPX	Ferris, Baker Watts	5	3743 - Railroad Equipment
QCCO	Ferris, Baker Watts	5	6099 - Functions Related to Depository Banking
RRGB	Banc of America Securities	8	5812 - Eating Places
RJET	Merrill Lynch & Co.	9	4512 - Air Transportation, Scheduled
RNOW	Morgan Stanley & Co.	9	7372 - Prepackaged Software
SAFT	Credit Suisse First Boston	9	6331 - Fire, Marine, and Casualty Insurance
SNTS	SG Cowen Securities Corp	6	2834 - Pharmaceutical Preparations
SNMX	Citigroup Global Markets	9	8731 - Commercial Physical Biological Research
SUAI	Friedman, Billings, Ramsey	5	6331 - Fire, Marine, and Casualty Insurance
STAN	William Blair & Company	7	7510 - Automotive Rental And Leasing
STXS	Goldman, Sachs & Co.	9	3845 - Electromedical Apparatus
STON	Lehman Brothers Inc.	9	7200 - Services-Personal Services
ELOS	Citigroup Global Markets	9	3845 - Electromedical Apparatus
TSRA	Lehman Brothers Inc.	9	3674 - Semiconductors and Related Devices
TCBI	Lehman Brothers Inc.	9	6022 - State Commercial Banks,
TXRH	Banc of America Securities	8	5812 - Eating Places
PRSC	SunTrust Capital Markets	6	8300 - Services-Social Services
TOPs	Cantor Fitzgerald & Co.	6	4412 - Deep Sea Foreign Transportation
TWGP	Friedman, Billings, Ramsey	5	6331 - Fire, Marine, and Casualty Insurance
TRIS	Capital Growth Financial	3	7381 - Detective, Guard, and Armored Car

UCTT	Credit Suisse First Boston	9	3674 - Semiconductors and Related Devices
VLCM	Wachovia Capital Markets,	7	2300 - Apparel
VLTR	Goldman, Sachs & Co.	9	3674 - Semiconductors and Related Devices
WRES	KeyBanc Capital Markets	5	1311 - Crude Petroleum and Natural Gas
WCAA	Friedman, Billings	5	4953 - Refuse Systems
WYNN	Deutsche Bank Securities	9	7990 - Miscellaneous Amusement
XNPT	Morgan Stanley & Co.	9	2834 - Pharmaceutical Preparations
ZUMZ	Wachovia Capital Markets	7	5600 Retail-apparel, retail, service